CHEMICAL & METALLURGICAL ENGINEERING

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CHEMICAL & METALLURGICAL ENGINEERING

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S. D. KIRKPATRICK, *Editor*

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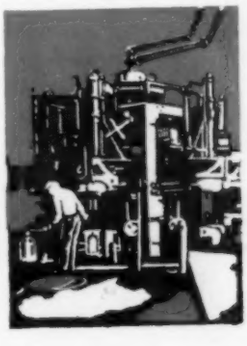
Meeting the Responsibility for Technologic Unemployment

LATELY, two remarkable volumes, "Whither Mankind" and "Toward Civilization," have focussed attention, from opposing viewpoints, on some of the most serious but least tangible of the problems of our present-day civilization. In the former a group of specialists in the humanities—law, economics, and ethics—advanced the thesis that science and machinery were undermining the human, moral, and cultural values of life. To the engineer and technologist this seemed a challenge that could not go unanswered. Hence in the second volume, edited by the same eminent historian, a group of the leaders of our sciences and professions—Millikan, Pupin, Kimball, and Sperry, to mention but a few—have attempted to prove that men of science and engineering recognize and are willing to accept their responsibility to humanity. Technologists are shown to be thinkers as well as doers. They are not indifferent to the human aspects of their revolutionary activities.

YET it is a severe indictment that in our present industrial situation one of the causes of unemployment should be laid at the door of the engineer and scientist. When men have been displaced by machinery there is an obligation which cannot be disregarded. In certain branches of the glass industry, for example, marvelous creations of mechanical ingenuity have taken over the work of hundreds of artisans. A single machine can now make a substantial proportion of all the incandescent light bulbs required by the entire country. Did its invention mean the scrapping of human equipment? In this case, it did not.



AT CORNING GLASS WORKS, a far-seeing and, incidentally, a technically trained management recognized its responsibility not only to the company and the industry but to the community in which it lived. The men whose toil, even though repetitive, had built the company's business were given opportunity for more creative work. Machines were not installed until the business could be expanded to take care of the men who had to be displaced. Even those artisans ill fitted for mechanized mass production found a place in the organization to continue their art and craftsmanship.

SUCH PRACTICAL IDEALISM is not met in every industry, yet its remarkable success commends it for more general application. Ralph E. Flanders, one of the brilliant defenders of "The New Age and the New Man," has well expressed this obligation in "Toward Civilization": "The new man, the engineer type—whether he is a directing executive, a practical laboratory scientist, or an inventor—cannot refuse responsibility for the brood of vital mechanisms which has grown from his work and has fashioned the world he operates. He has wrought the intricate framework of the machine age; he has an obligation to society for his product."

EDITORIALS

MAY, 1930

International Industry Strengthens Acquaintances

SEVERAL THOUSAND engineers and industrialists will spend nine June days proving again that, apart from lingual disparity, they are pretty much the same the world over. Congregated at Berlin, they will get acquainted, talk things over, listen as well as talk, eat and drink together, and in general constitute the Second Plenary World Power Conference. Their modest official aims are merely the exchange of ideas on a professional affair and the contact of the three groups—engineering, economic and financial—that give the world its Power. But, of course, their affair is an international one, involving not only matters of coal, oil, boilers and high-tension lines but also the living conditions and economies of every human community. Unhampered by notions of appealing philanthropies and individual advantage, they can be expected to settle these questions with an amicable brevity that should leave the fifty representative nations favorably disposed to fostering this industrial basis of friendly acquaintanceship.

•

An Outsider Looks In On Ferrous Metal Research

EVEN in the steel industry it is not generally known that Sir Henry Bessemer was a rank outsider. According to H. M. Howe, he had "no great knowledge of metallurgy." He received his knighthood not for his steel process but for the invention of a method for preventing the counterfeiting of British revenue stamps. In common with the great inventor, Dr. Arthur D. Little claims no intimate knowledge of the metallurgical science, yet as an outsider looking in on this great industry he has been impressed with its urgent need for a comprehensive, well co-ordinated program of research. The scholarly paper he delivered before the Iron and Steel Institute on May 9 is a most convincing brief for science.

The industry has depended too long upon outside agencies for research in the solution of its problems. The Bureau of Mines and the Bureau of Standards, the Iron Alloys Committee of the Engineering Foundation, and the individual workers in the universities and colleges have contributed generously. One or two manufacturers have made a promising start in accumulating fundamental data on the properties of iron. Now, according to Dr. Little, the time has arrived for definite action on a scale worthy of an industry that supplies the material basis of our civilization. He lists a number of compelling reasons: Corrosion losses amount to three billions a year. The industry admittedly is ignorant of many of the factors fundamentally concerned with the operation of its processes and the quality of its products. New and effective instruments and agencies for research are now available with undreamed-of possibilities. Lastly, the prosperity of this country is so intimately bound to iron and steel that as a nation we cannot afford to have it lag behind in the march of scientific progress.

Chemical engineers, too, have a selfish interest in this matter. Our demands on the steel maker are becoming increasingly severe. The high pressures and temperatures involved in modern catalytic processes necessitate superior resistance to erosion, corrosion, gas penetration, in addition to great strength at elevated temperatures. For these reasons the tonnage of high-alloy steels used in chemical industry will continue to increase. If the industry is going to meet these new demands on the broadest possible scale, something more is necessary than laboratory control. That "something" is the guiding, vitalizing influence of industrial research.

A Worth-While Investigation of Western Wood Pulps

IT IS PROPOSED that there be an investigation made by the Forest Service of the pulping properties of Western woods, notably the production of light-colored pulps from Douglas fir. There is good reason for believing that Congress may authorize this investigation and afford a small initial appropriation of $10,000 to start the work during the coming fiscal year. This is a project which deserves even greater support.

It is probable that there is no point in the United States where pulpwood is as cheaply available as in the Western states. Estimates of the forest products engineers indicate that in some cases logging waste affords wood at a material cost approximating two dollars per ton of pulp if kraft pulp be made. Even for higher grade pulps the average cost in the West probably is less than half the wood cost in, say, New York State.

Western lumber interests have suddenly discovered the potentiality of these investigations and are urging upon Congress that the Forest Service be given $30,000 immediately, instead of the smaller sum at first proposed. They realize that with the smaller investigation the work probably would have to be limited to Douglas fir, which is only a small part of the problem for Western species. White fir, Western yellow pine, and redwood, which are available on tidewater, also have great possibilities of immediate utilization. Looking still farther ahead, there should be work also on lodgepole pine, Western larch, cedar, red alder, and Engelmann spruce. In the case of a number of the more available species there is enormous waste incident to lumbering that can quickly be diverted into profitable channels of pulp production if the needed research on pulping methods is done. With cheap water transportation from Western tidewater into the consuming areas along the Eastern seaboard, the long freight haul apparently does not absorb all of the margin of advantage which cheap waste wood affords. Hence, these Western developments offer a very real potential substitute for imported Canadian pulps which now supply about half of our needs. They would tend to stabilize pulp prices and insure that any differences of opinion between Canadian interests and those of this country need not lead to any serious conclusion.

Chem. & Met. commends very strongly this proposal of Western pulp studies. If Congress is not willing to afford all the money, it will be a short-sighted group of lumber interests that fails to provide the balance.

Safer Applications for Hazardous Materials

"THE HISTORY of benzol in industry is that of many poisons: a newly cheap material comes rapidly into use; its toxic properties become slowly discovered. Some concurrent movements are set on foot; one to ban the use of the material, another to remove its dangers if possible, or to provide substitutes. The process is slow and may even be characterized as irrational. The proper procedure is for industry to acquaint itself first as to the toxicity of such new industrial hazards as that of benzol."

This is a very rational statement and one for which all responsible chemical executives can cordially commend the Bureau of Industrial Hygiene of New York State, from which office the announcement comes. There are many legitimate and proper applications of benzol. With proper precautions these applications can be extended widely and beneficially throughout industry. But there is no warrant for careless use of a solvent known to have toxic properties. Nor is there justification for starting in with new chemicals in work which involves personal exposure of manufacturing workers or of users until it has been properly determined that the exposures involved are safe.

It is well known that many chemicals have insidious physiological effects not readily noted in the early stages. There is a moral responsibility upon manufacturers of chemicals when they bring out a new product to see to it that it complies with all proper requirements for safety to life and property. The principal companies in our industries have recognized this responsibility. Fortunately, they have the sincere co-operation of state and federal officials in their efforts. These officials must protect public safety, but they are anxious to do so without unreasonable restriction upon new developments in industry. This is as it should be. It is an attitude, however, which should stimulate greater care on the part of chemical manufacturers and a keener appreciation of their responsibility.

Why Didn't We Think of That?

EVERY SO OFTEN someone evolves an idea which arouses both our admiration and our envy. Such an idea was described by Horace Freeman, chemical and metallurgical engineer of Shawinigan, Que., at the March meeting of the Canadian Institute of Mining and Metallurgy. It involves a new method of burning pyrites, borrowing from the powdered-coal furnace features which yield a gas rich in SO_2, a cinder that is ready for the blast furnace without further treatment, and a quantity of byproduct steam.

Sulphur requirements of Canadian pulp mills have hitherto been met almost entirely with imported sulphur. Cleanliness, rich gases, and low equipment investment have been determining factors in this choice, despite the ample supplies of the cheaper pyrites that are readily available in Canada. It was in the effort to establish pyrites on an economic basis as a suitable sulphur material that the present investigation was undertaken at Shawinigan Falls in 1926. Early work showed that finely ground sulphides of both iron and zinc would satisfactorily support combustion when suspended in air. Consequently a small 1-ton furnace for iron pyrites was built at Shawinigan Falls in 1927, followed by a 20-ton-per-day unit at the St. Maurice mill of the Canadian Power & Paper Corporation in 1929.

Pyrites evolves well over 3,000 B.t.u. per pound, about twice as much heat for equal volume of SO_2 as can be obtained in burning sulphur. This accounts for the steam-raising possibilities of the new method. At the St. Maurice mill pyrites concentrates averaging about 50 per cent sulphur are ground in a ball mill swept by air preheated in the combustion chamber. This air accomplishes both the necessary drying and the conveying of the ground product to the furnace. The latter is a vertical, insulated, firebrick-lined chamber into which the pyrites particles are blown at the top, meeting an upward current of secondary combustion air which hinders their fall long enough for complete combustion. As the particles descend, there is a rapid evolution of elemental sulphur which leaves the cinder in a porous, puffed-up form capable of agglomerating with other particles to form a material well suited for blast-furnace use.

Combustion temperature in the chamber is about 1,150 deg. C. The gases, including unburned sulphur, pass into a final combustion chamber and thence through a fire-tube boiler where they are cooled so rapidly to 250 deg. that only traces of SO_3 are formed. Steam at 165 lb. pressure is generated to the extent of about 1 lb. per pound of pyrites. Exit gases contain 11 to 12 per cent of SO_2.

Extensive trials doubtless will be needed to show what effect this burner will have on general production of SO_2. But with its ability to yield a satisfactory sinter immediately, together with a strong, comparatively clean gas and a considerable quantity of steam, sufficient to pay for the operation, this development would appear to be a strong potential contender for attention in both the acid and paper fields.

Engineering and Idealism

ACCUSATIONS that the engineer is converting men into machines and that the wealth thus created is the cause of moral and spiritual decay were effectively answered by E. J. Mehren in his address on the occasion of the fiftieth anniversary of the founding of the American Society of Mechanical Engineers. He reminded his hearers that "There have been hewers of wood and drawers of water in every age." Some men will continue to do repetitive work, but never was the search so keen for men with initiative and energy for creative endeavor. "Far from deserving blame for the acceleration of wealth, the engineer deserves the greatest praise, for he has prepared an environment more favorable to moral and spiritual growth than the poverty, squalor, and disease that preceded it. If character development has not kept pace with wealth creation, it is largely the fault of the lay and religious teachers who most often bring the charge." If the engineer is not to be credited with idealism, it must be admitted that he has made practical idealism possible.

Unique Features Characterize

SOUTHERN K

The Gulf States company's kraft mill differs radically from most others in the details of the chemical recovery

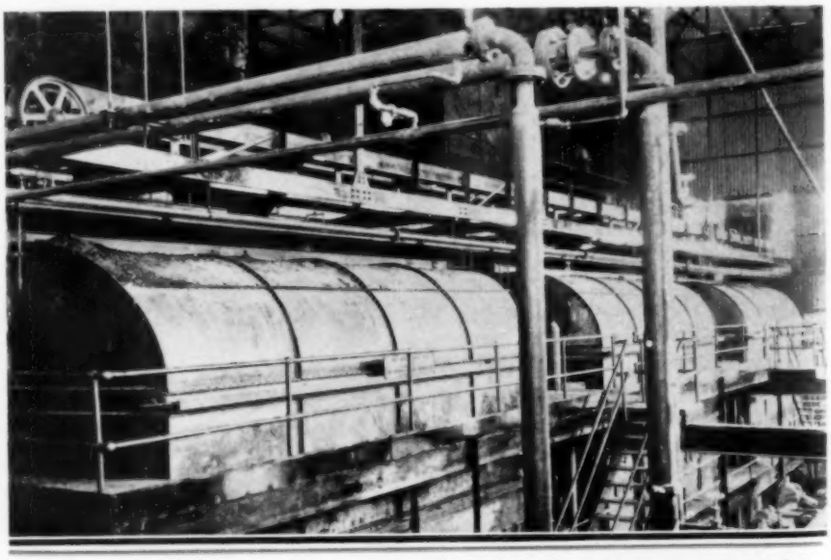
THE "OLD SOUTH" is not the most fertile section of the United States, despite the contrary belief of many of its inhabitants, but one thing it can do and does is to grow cellulose, without fertilizer and without cultivation, at a rate unapproached by any other district. Cellulose is mostly in the form of pine trees—long-leaf yellow pine, slash pine, and the many varieties of short-leaf, including spruce pine. The speed with which an abandoned cotton field will cover itself with handsome "field" pines 8 to 12 in. in diameter is a source of astonishment to one accustomed to the deliberate growth of spruce in northern latitudes. It has been shown repeatedly that a cut-over tract in the South will be ready for cutting again in one-third the time required for a similar area of spruce. Little wonder that paper plants have been following the textile mills southward, and when the production of paper, other than kraft, from pine, has become general, the movement will be greatly accelerated.

Alabama is best known as a coal and iron district, but a start has been made in its growth as a cellulose state quite apart from its annual production of one and a half million bales of cotton. Within the last 15 months two kraft-paper mills have been built and put in operation within the state, one at Mobile by the International Paper Company, the other at Tuscaloosa, owned and operated by the Gulf States Paper Company. It is with the latter that the present article is concerned. Parts of this mill follow the conventional lines of the sulphate process, but there are several novelties in design, and it is to these that attention will be directed. Attached to the mill is a large paper-bag factory, operated by the same company, which consumes a considerable part of the output of the mill.

Tuscaloosa, the site of the mill, is located on the Warrior River, 60 miles from Birmingham, on the edge of the Warrior coal field, one of the major coal areas of the continent. There is barge navigation on the river from Birmingport to Mobile on the Gulf of Mexico. Both sides of the river, the territory adjacent to the railroad, and that along the highways carry good stands of pine, which fact insures the mill an ample supply of wood for all time to come. The Warrior River at its lowest stage carries ample water to supply the needs of the plant. Thus there are provided the three major requirements: wood, fuel, and water. Power, which is subordinate in importance to steam in this type of mill, is generated by the company itself in an adjoining building, though a connection exists with the lines of the Alabama Power Company to take care of emergencies. The chemicals required, salt cake, caustic and lime, are brought from a distance, as there is no local supply. Last, but not least, the mill has been able to draw upon a plentiful supply of local labor of a high type.

The accompanying flow sheet shows the course of the materials through the mill. Only the features which depart from established practice will be discussed in detail.

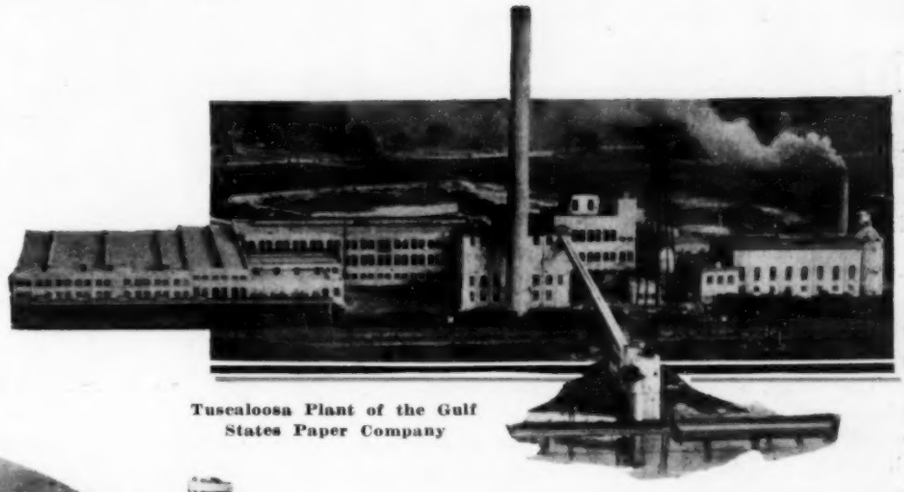
Handling of the wood, its debarking, chipping, and introduction into the digesters proceeds along orthodox lines. A combination of direct and indirect cooking, which is not common, follows these operations. Live steam at 125 lb. is sent into the digesters, in contact with the wood, for the direct cooking, and the liquor likewise is constantly circulated through a Morterud heater, to secure pressure for the indirect method. Either one of



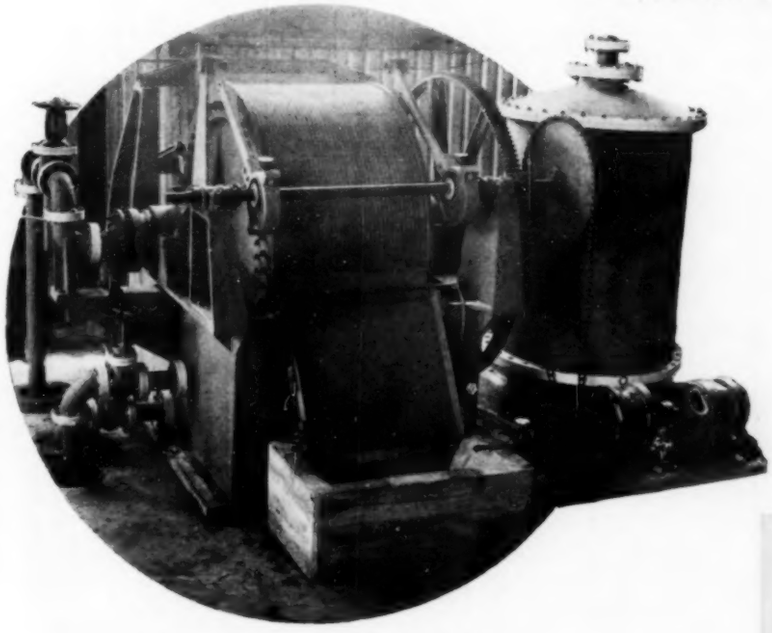
This Recovery Furnace Is an Evaporator, Driving Off the Last 30 Per Cent of Water in the Liquor; a Steam Producer; and a Reduction Apparatus, Converting the Make-up Salt Cake Into Sodium Sulphide

N PAPER PLANT

By STEWART J. LLOYD
Professor of Chemical Engineering
University of Alabama



Tuscaloosa Plant of the Gulf States Paper Company



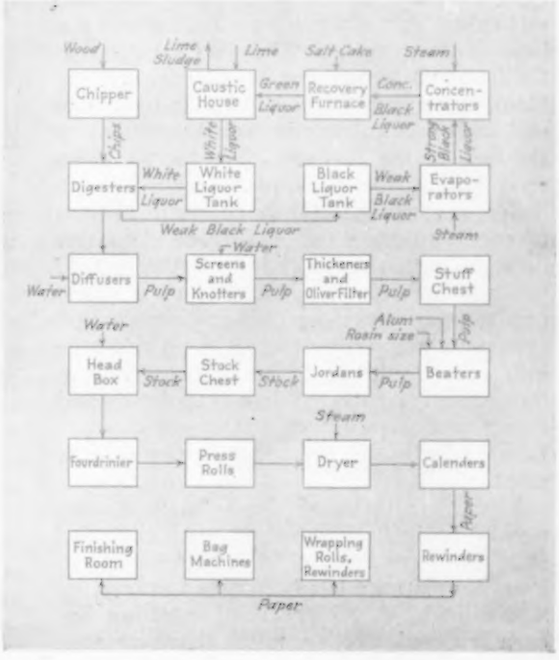
A Sludge Filter in the Sulphate Mill

these alone is common; the two together are not. When the digester is blown off, the gases from it are condensed in a cyclone separator using a jet condenser. There are four of these digesters with a capacity of 7 tons of pulp per cook. Pulp from the digester goes to the diffuser: not a very efficient piece of apparatus, but one in common use. It is likely that diffusers will be replaced in many mills by continuous filters. After washing in the diffusers, the pulp passes to the screens, where uncooked wood and knots are rejected and returned to the digesters.

Another novel feature is found at this point. Between the screens and the paper machine there are no pumps, gravity and jordans taking their place. From the screen the pulp passes to thickeners, the water from which goes to an Oliver filter to avoid loss of pulp. In the beaters, which comprise the next step, the alum and size (rosin) are added. The pulp then goes to the jordans, which in addition to their own function, act as pumps to lift the pulp to a point where gravity will convey it to the paper machine.

The paper machine has a width of 234 in. and a 220-in. trim. Press rolls, dryer, and calender are of conventional design. In the dryer the Ross system of humidity control is used with much

Flow Sheet Showing Course of Materials Through the Mill



success. Some of the paper passes to the bag factory near by, while some is shipped as wrapping paper. The mill is rated at 80 tons, but is now averaging 100, and has reached 130 per day.

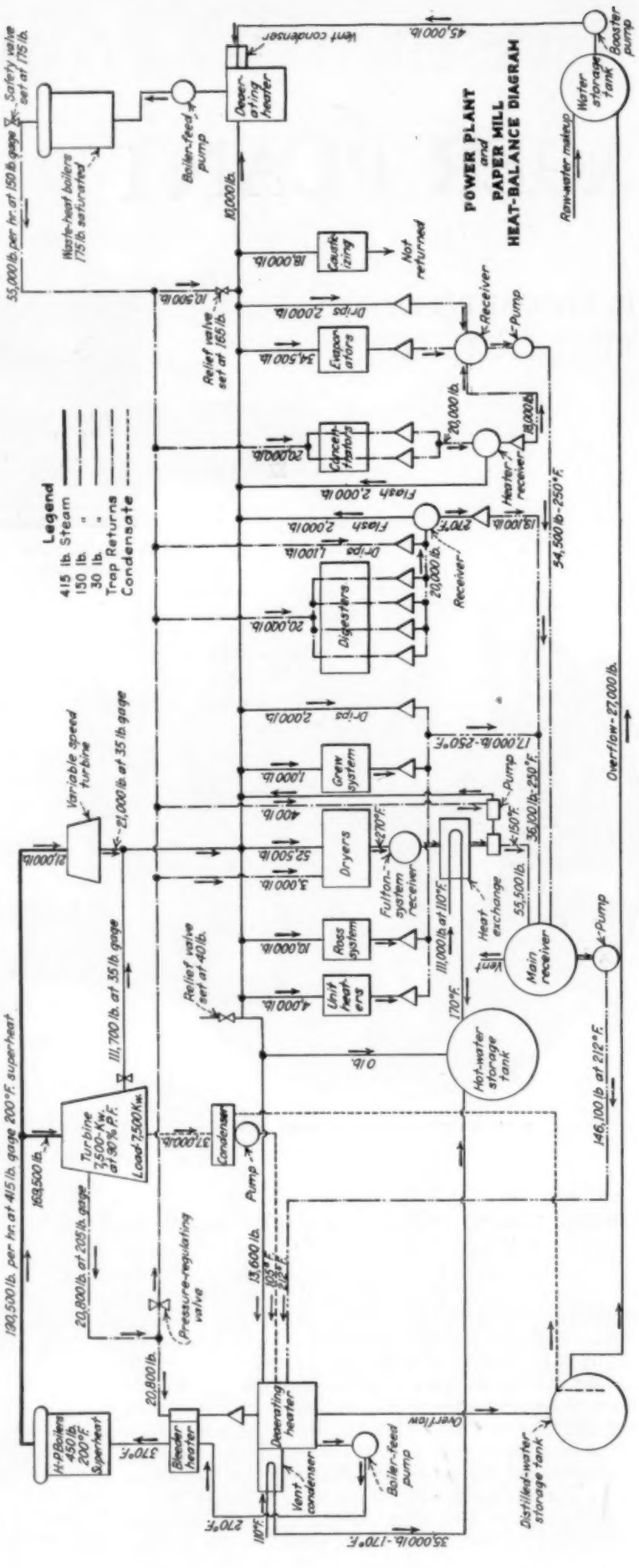
An interesting innovation in the bag factory is the combination printing and bag machine which prints in two or three colors directly in the machine. As far as the writer knows, this particular machine is unique.

MORE interesting to the chemical engineer is the life history of the chemical solution—the "liquor"—which cooks the chips and dissolves their non-cellulose part. It is diluted by wash water and concentrated again. The woody matter is burned out, fresh salt cake added, and the liquor is redissolved and used over again with more chips. Chemical recovery is essential in the sulphate process, and it is in the details of this recovery that the Gulf States mill differs radically from most others.

The "black liquor," containing sodium sulphide and sodium hydroxide and all of the wood except the cellulose, passes from the digesters, and is of necessity weakened by adding some of the wash water from the diffusers. It then passes to a Joubert & Goslin quadruple-effect evaporator, which raises the solid content to 50 per cent. Swenson high-density concentrators then increase the solid content to 70 per cent, and the heavy viscous liquid, steam jacketed to prevent solidification, is pumped to the recovery furnace.

This furnace is original with William Cary, superintendent of the plant. It is a rectangular, vertical structure, built of firebrick and soapstone, water-cooled throughout, and capable of handling liquor corresponding to 75 tons of pulp per 24 hours. The liquor is sprayed into the two ends of the furnace near the top, through special type nozzles simultaneously with make-up salt cake. Air is admitted a little above the base of the furnace. The woody matter in the liquor is burned out by the air, and the resulting mixture of molten sodium sulphide and carbonate collects in two depressions in the base of the furnace. The hot gases on their way to the stack pass over a 725-hp. boiler, producing 6,000 lb. of steam per ton of paper produced. The furnace is thus at once an evaporator, driving off the last 30 per cent of water in the liquor; a steam producer, as just indicated; and a reduction apparatus, converting the make-up salt cake into sodium sulphide. The contrast between this system and the old disk evaporators and rotary smelting furnace will appeal to those familiar with the soda and sulphate processes.

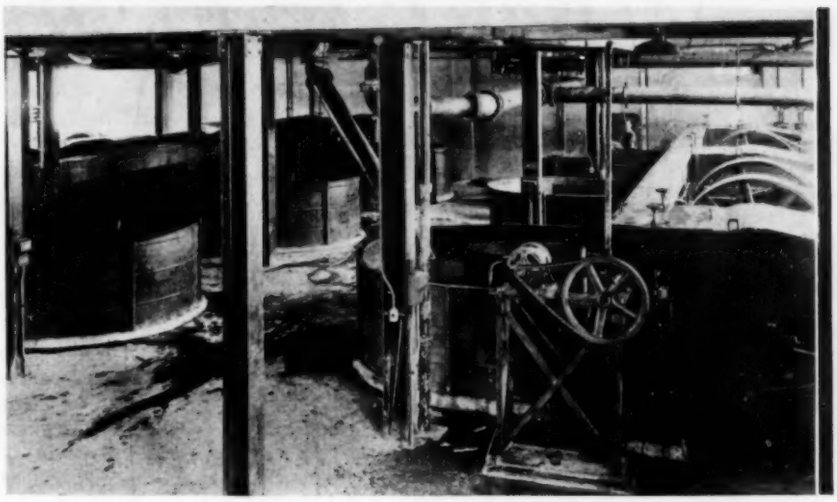
There are three of these furnaces, two usually being in commission, with the third shut down for repairs. On occasion, however, one furnace has been able to carry the whole load. A 95 per cent reduction has been achieved, which is much above common



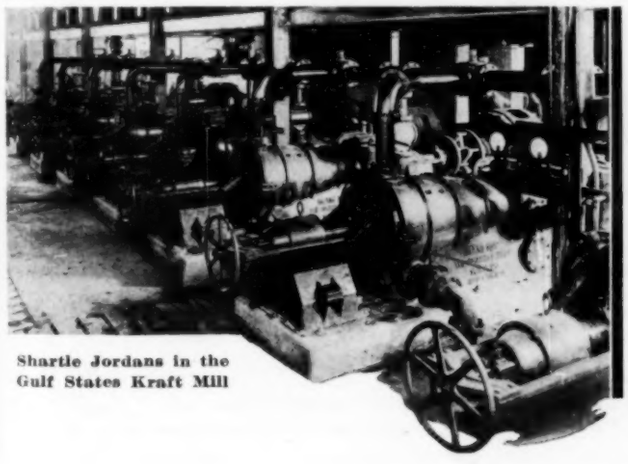
practice, while six weeks is the average time of run before repairs are necessary.

The molten mixture of carbonate and sulphide passes to the dissolving tanks, then in the form of "green liquor" to the causticizing tanks, where lime is added. The calcium carbonate produced is not reburned but sent to waste. The resulting white liquor is decanted off, and goes finally to the digesters for re-use.

Though a sulphate mill does not consume as much power as a groundwood plant, its power requirements are considerable. Since large quantities of steam are required for cooking, evaporating, drying, etc., it is natural, where fuel is cheap, to combine the production of power and steam. This has been done by the Gulf States company, in a steam-power plant located in an adjacent building. A 7,500-kw. generator, utilizing 450 lb. pressure, 200 deg. superheat, provides the power, and the exhaust steam, at 100 lb. or less, is used throughout the plant. The waste-heat boilers of the recovery furnaces, mentioned above, contribute unexpected quantities of steam.



The Beaters in Which the Alum and Size Are Added, in the Tuscaloosa Plant of the Gulf States Paper Corporation



Shartle Jordans in the Gulf States Kraft Mill

Sulphate mills in the past have had a bad reputation for contaminating the atmosphere with sulphur odors, due largely to mercaptans and similar sulphur compounds. While the Gulf States plant is not completely odorless at all times, the substitution of the Cary furnace for the old recovery system has greatly lessened the evil, so that only at infrequent intervals can the odor be detected at any distance from the plant.

The general appearance and layout of the plant, with its avoidance of unnecessary handling of materials, its elaborate safety measures, and provisions for employees' comfort, is indicative of the new type of manufacturing unit which is spreading through the South. A progressive and humane management, alive to its responsibilities to the people it employs and to the community in which it lives, has made the Gulf States company a welcome addition to the industrial life of Alabama.

Improving Throwing Power in Chromium Solutions

DURING recent years chromium plating has come into extensive use, notably on automobile and plumbing fixtures. In this process it is difficult to deposit chromium in the recesses or remote parts of irregularly shaped articles. In the language of the platers, the solution has poor throwing power. It is important to define and employ those conditions of operation which will yield the most uniformly distributed deposits. The American Electroplaters' Society has, therefore, supported a research along these lines at the Bureau of Standards.

The results of extensive studies show that any revolutionary improvements in throwing power are improbable. It will, therefore, still be necessary for the platers to exercise their ingenuity to so arrange the articles in the tank as to get the current density as nearly uniform as possible.

By the use of relatively dilute solutions of chromic acid, with a low sulphate content and at a fairly high temperature and current density, better throwing power is obtained than under the reverse conditions. When, however, as is generally true in plating plants, the available voltage is less than six, lower temperatures and current densities must be used.

Chromium plating is entirely practicable, as shown by its present extensive use. This study shows that it will continue to require more care and ingenuity by the platers to produce complete covering with bright chromium deposits than does plating with nickel or other metals that are used.

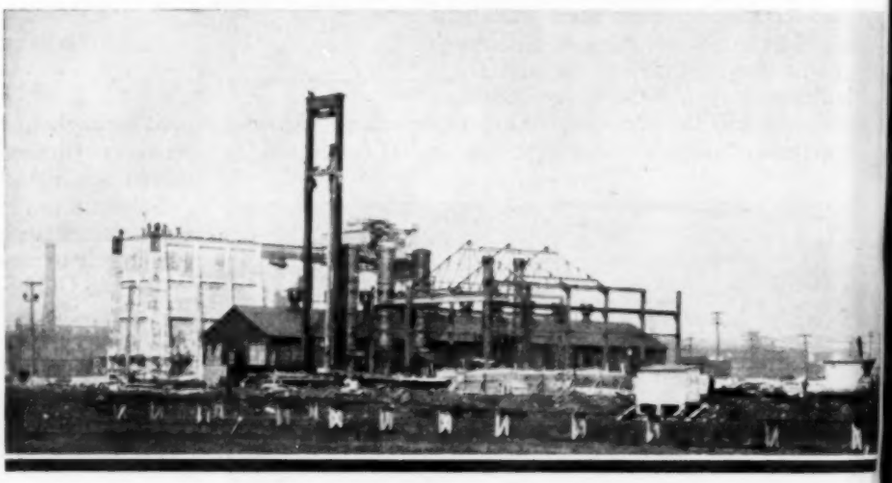
What Chemical Engineering

PETROLEUM

Although comparatively a newcomer in this long-established field, the chemical engineer has already worked great changes and now promises even more important developments in the hydrogenation of petroleum products. In a recent address on "The Engineer and Petroleum," published in full in the February issue of his company's magazine, "The Lamp," Mr. Howard traced the influence of all of the major branches of engineering.

THE MAJOR business of refining petroleum is neither a strictly mechanical nor a strictly chemical operation. With rare exceptions, the engineer of even thirty years' past felt that he was completely out of his element unless he had a surveying instrument, a drafting board, a metal working machine, or a power plant to deal with; the chemist, with equally rare exceptions, became a fish out of water when he left his laboratory.

Within a limited sphere the chemist has always been a mainstay of the petroleum industry. He devised the tests and the instruments for testing by which products were standardized and did much definitely to advance the art of refining. But even the universal and basic chemical refining process consisting in the treatment of oil with sulphuric acid was, and still is to a degree, so complex in its chemistry that practical knowledge and experience rather than chemical training were the requisites for the guiding hand. For this primary reason one of the greatest, most successful, and most typical American industries of the mass production type, which is said to be the highest embodiment of American engineering genius, really arrived at full maturity and at a level of efficiency which is not now equalled by all of its younger brothers. This has been done with a minimum of help from applied science in the form of technically trained engineering talent.



Petroleum Hydrogenation Plant N

But the petroleum industry suffered, to a degree at least, from those faults characteristic of the self-made man. That is, having arrived at a most unusual state of prosperity and efficiency largely by its own efforts and with a minimum of reliance either upon alien industries or upon formally trained experts, it became too nearly self-sufficient in its own estimation, and as a result was unnecessarily slow in calling to its aid the specialists who were at that time working mechanical and chemical wonders in other lines.

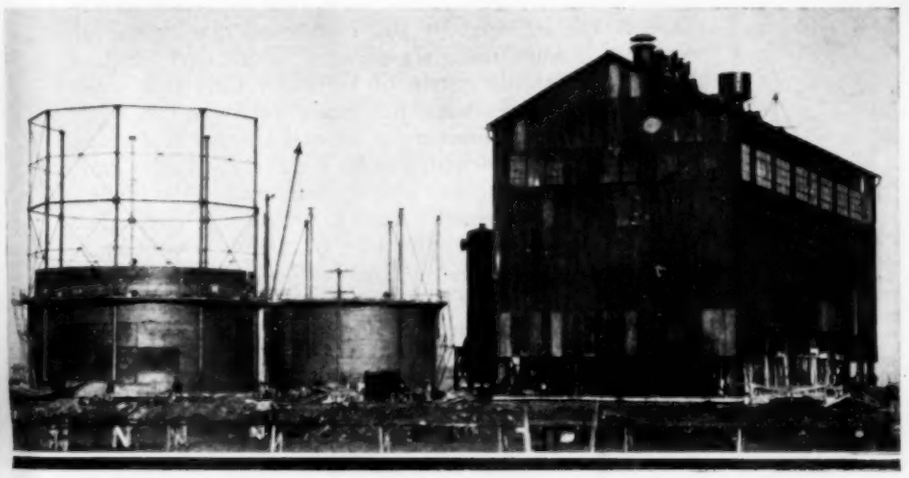
In the actual production of oil—that is, the drilling of wells and the raising of the underground liquid to the surface—almost every branch of the engineering profession has taken an active hand within recent years. The most outstanding developments are perhaps those which brought forward the modern rotary drilling rig as a tool for cheaply and expeditiously sinking wells to great depths through a wide range of formations. In lifting oil the outstanding development has been the substitution of the gas lift for the direct-acting pump. The gas lift, while perhaps the most outstanding single piece of development work, is only one of a host of important improvements in the utilization of natural gas, either that which accompanies crude oil production or the gas produced from dry wells. Through the pioneering of the chemist, with the help of the mechanical engineer, and through the later work of that indispensable specialist, the chemical engineer, who seems to have been created by nature particularly for the benefit of the petroleum industry, the natural gas now serves as the source of a quantity of gasoline, far greater than the total production of the world not so many years ago. Total gasoline recovered from natural gas by these methods in the last year was about 1,000,000 bbl. per week.

It is in refining that engineering development has been most interesting and varied. The traditional distillation method, wherever complete refining was aimed at, was the batch type of coking still. This standardized piece of equipment charged about 1,000 bbl. of oil at a time and reduced this charge to a dry, hard coke representing perhaps 2 per cent to 5 per cent by weight of the original charge, at the end of 36 to 72 hours. The first separation which was thus accomplished was, therefore, a strict case of fractional distillation. In its final form this equipment made considerable use of the principles of fractional condensation as well.

Has Contributed to the INDUSTRY

By FRANK A. HOWARD
Vice-President,
Standard Oil Development Company

Pouring Some of the 4,700 Cu.Yd. of Concrete That Went Into the Bayway Plant



Nearing Completion at Bayway, N. J.

The industry is now distinctly on a basis of continuous distillation units. The development of the pipe still type received a tremendous impetus through the forced adoption of this same design for cracking or conversion equipment. Having been compelled to work out enormous and efficient pipe stills to carry on its conversion operations and enabled to do this by an advance of the engineering professions, particularly in respect to metallurgy and furnace design, refining operation went over largely to this type of unit for its new construction. The largest modern refineries average short of 100,000 bbl. per day capacity, although some few exceed this figure. Pipe stills for the first distillation of crude oil are now built in capacities up to 15,000 bbl. per day.

Perhaps the greatest single contribution to petroleum refining by the engineering profession has been the work of the chemical engineer in reducing to definite, usable form, the physical laws covering the distillation of mixed liquids. All attempts to transplant the technique of older industries over to the main problems of petroleum met with failure until the chemical engineer stepped in. Since then the advance has been really revolutionary. Rectification operations have been raised to such a high state of perfection that straight fractional distillation, the original mainstay of the petroleum industry, is abandoned entirely in many modern installations. The oils to be separated are converted wholly into vapor in a single step of continuous operation and the whole operation of separation is thrown upon a rectifying column, which thus assumes this load in addition to its original burden of fractional condensation of vapors delivered to it in a reasonably well classified form by fractional distillation. The column is nevertheless able to make separations which would have been the despair of a refiner of even ten years ago.

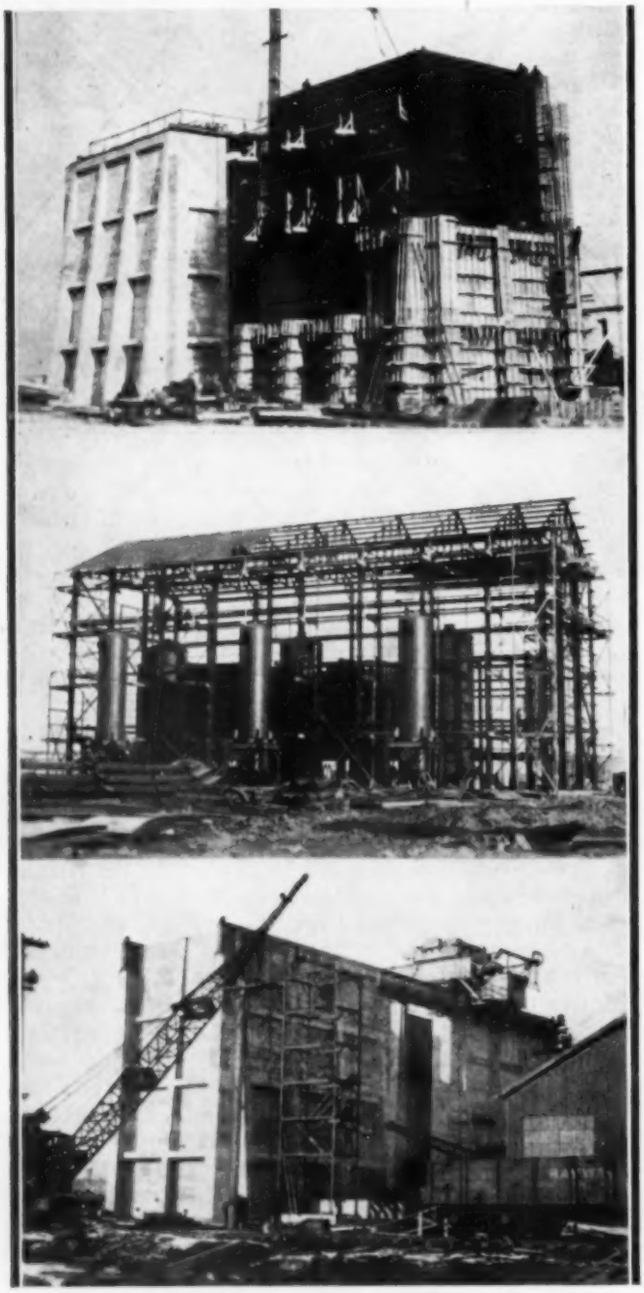
Another extremely interesting aid to petroleum distillation operations for which the industry is indebted to the engineering profession is the vacuum jet. Chemical engineering gave indispensable help in supplying the data upon which designs could be based with reasonable foreknowledge of the exact pressure drop which would be met between the point of liberation of the vapors and the point at which the permanent gases were evacuated from the system.

Among the most interesting of engineering contributions has been the successful outcome of the search for an anti-knock agent. The fact that this chemical need was first appreciated by an engineer, Kettering, and the problem solved by another engineer, Midgely, through years of brilliant chemical research, leaving to the oil industry and to the chemical profession only the secondary problems of obtaining tetra-ethyl lead in the required quantities at a low cost and distributing it economically, is a useful sidelight on the essential unity of industrial progress in this age of applied science.

Let us turn to another division of the oil business, the art of cracking. About 1911, when the demand had shifted away from kerosene and toward gasoline, a new conversion method was quite obviously needed. William

M. Burton, a doctor of philosophy in chemistry who had received his training under one of the greatest of our scientists, Dr. Ira Remsen, first produced a practical solution of the problem in the pressure still. He discovered that by treating a definite fraction of the oil under a definite pressure and at a definite temperature range, it was possible to obtain large yields of gasoline by cracking. About eighteen years ago Dr. Burton put the first high pressure still into operation. During the next five years pressure still batteries grew up like mushrooms. There was some engineering but none too much in their design. Mainly they were the products of routine drafting and intelligent and experienced, but purely practical boiler making.

Just about that time the engineer began to come into his own. The pressure still at its highest stage of development cost about $50,000 for a unit which turned out 75 bbl. of gasoline per day. This pressure still has now been supplanted by continuous pipe or coil type of cracking units. A standard design at the present time costs about $250,000 and turns out roughly 1,000 bbl. per day. The reduction in investment per unit of output has therefore been about 60 per cent. Proportionate or greater economies in fuel consumed and labor employed have followed. Safety has been enormously increased.



Hydrogenation Plant Under Construction

Top—Huge concrete stalls will inclose the reaction towers in which the oil is hydrogenated.
Center—Where the hydrogen will be manufactured.
Bottom—Getting ready to set the high-pressure equipment in place.

AT THE present time it appears that the petroleum industry may be just about to enter a third and perhaps more far-reaching phase of its history as a conversion or true manufacturing industry, that is, hydrogenation. The scientific and engineering background of this development is so vast as to dwarf all previous experience. Pure chemistry and physics and all branches of engineering have already and in the future must continue to supply the best of which they are capable, if this new development is to realize what now seems to be its definite possibilities. The fact that this development was fathered by the foremost organization of scientists and technologists engaged in industry, that is the I. G. Farbenindustrie of Germany, and that even with their resources some five years were spent in what might be called preliminary work and another five years in development participated in by the Standard Oil Company (N. J.) before any attempt was made at commercial operation in the oil industry, provides a fair index of what it involved in the way of technical problems.

It may fairly be asked what was the compelling reason for undertaking such an ambitious and necessarily costly development. The answer is that it was proved that hydrogenation gave a definite solution of all present basic problems of the petroleum industry. In the first instance, hydrogenation effectively and practically converts coal into oil. The world's coal reserves have become the world's oil reserves. Thus for hundreds of years at least the basic problem of an adequate future supply of liquid hydrocarbons is settled. Second, hydrogenation produces 100 per cent slightly more or less, by volume of gasoline from the lowest grade of crude liquid hydrocarbons derived either from coal or oil. Third, hydrogenation shows many interesting possibilities for other conversion operations by which any desired grade or quality of hydrocarbon product may be obtained without prohibitive economic cost. It is as yet too early to attempt any strictly commercial analysis of this development. Of its outstanding importance and the gross economic changes which it effects in the petroleum industry there can be no doubt.

It is true that known crude oil reserves are not unlimited, but the most pessimistic estimate which could now be made must place their exhaustion at least a full generation ahead and a reasonable view would place it at least two or more generations ahead. You may accept it as a fact that the hydrogenation development makes possible and reasonably economical a gasoline production from crude oil about twice as great as present production, still leaving sufficient margin for the production of other petroleum products of high economic value in the proportions in which they would now appear to be required. Back of this, hydrogenation has made coal as well as shale a practically unlimited reserve and has shown that the transition from one source of supply to the other can be accomplished in a practical manner and without fatal disturbance to the consuming market or to the petroleum industry itself.

Economic and Industrial Prospects of

XYLOSE

A *Chem. and Met.* staff interpretation prepared with the co-operation of

WARREN E. EMLEY
Chief, Organic and Fibrous Materials Division, Bureau of Standards

XYLOSE is the first five-carbon sugar to be successfully manufactured on a semi-commercial scale. Its prospective industrial status, therefore, is of peculiar interest not only to those concerned with the raw materials from which it may be made but also to many potential users of it and its derivatives. There seems to be no doubt that it can be manufactured by a simple and practical scheme at a cost that brings it within the range of industrial application. The main consideration, therefore, is as to how it may be applied and with what industrial advantage. The answer to this demands a thoughtful review of the occurrence, method of production, and present costs, as well as prospective markets.

The classic approach to carbohydrate chemistry sets forth a series ranging from cellulose, lignin, starch, and dextrine through the sugars to alcohol, aldehyde, ketone and organic acid, with carbon dioxide and water as the final number of the series. Most of the members of this series down to the dextrine group are six-carbon compounds or multiples thereof. The dextrine group can be divided into the common six-carbon members and the less commonly noticed but very widely distributed five-carbon members properly characterized as xylans or pentosans. It is that xylan sub-group with which we are at present concerned.

Xylan, on simple hydrolysis, takes up a molecule of water and forms xylose, a five-carbon sugar analogous to dextrose, the common six-carbon sugar. Xylan occurs in large percentages in many industrial wastes, such as corn cobs, corn stalks, peanut shells, and cottonseed hulls. Strangely enough, xylan seems to be found in large percentages only in those portions of plants which are commonly regarded as non-edible for human purposes. For reasons not yet fully understood by the medical profession, the human animal seems to take for food only those parts of the plant, like the kernel of the corn or the grain of the wheat, in which the dextrine compounds are of the characteristic six-carbon variety. The industrial significance of this will be made clear from the discussion of the uses of xylose in a later part of this article.

COTTONSEED HULLS when air dried contain approximately 40 per cent by weight of xylan. Corn cobs and peanut shells are next highest in xylan content among the agricultural wastes which have been considered; they contain respectively about 32 and 26 per cent by weight when air dried. Fortunately for those who wish to make xylose and its derivatives, cottonseed hull bran appears to be available in the largest tonnages of any of the xylose-yielding materials. Approximately 2,000,000 tons a year of these hulls, containing approximately 800,000 tons of xylan, is available for industrial application, already concentrated at the cottonseed crushing plants of the country.

At these plants the cottonseed crusher makes four products: oil, press cake, linters, and hull bran. The first three have a ready and adequate market at more or less satisfactory prices. The hull bran finds no market; it is practically a nuisance, involving expense for disposal, because it is not even satisfactory as a fuel and cannot readily be burned under boilers without special care and apparently at an expense greater than the fuel equivalent furnished. Hence, the xylose maker has a prospective raw material of high concentration available in adequate quantity at a cost of almost zero, or even with some prospect of payment for disposal. Only where there is a limited market at low price for the hull bran to be used as a fertilizer filler or low-grade feed, will the raw material have competing uses.

HYDROLYSIS of xylan to xylose can be carried out on a commercial scale very simply by boiling the xylan-containing material with dilute acid, preferably under pressure. Hence, the making of the xylose involves no trouble. But its separation from the non-sugar constituents simultaneously extracted from the hulls is an extremely difficult problem because the ash, gums, and the protein constituents of the extract are splendid protective colloids, preventing crystallization of the sugar. Furthermore, any sugar than can be separated from the extracts is off-color and industrially very unsatisfactory, even after recrystallization.

The real achievement attained by the Bureau of Standards investigators in their development of xylose has actually been in the separation of this sugar sufficiently free from ash, gum, and protein so that it could be crystallized from the extract solution. It was, in fact, a recognition of the necessity for accomplishing this separation that led to the development of the successful process which has been applied by the Bureau on a semi-works scale at Anniston, Ala., in co-operation with the Alabama State Industrial Board. This Board has had the extended backing of the Swann Corporation, which has furnished most of the funds for the project, and the active participation in experimental work of the University of Alabama and Alabama Polytechnic Institute.

The process used at the Anniston plant (represented in flow on the next page) consisted first in washing the bran with hot water under 15 lb. pressure, followed

Producing Xylose on Semi-Commercial Scale at Anniston, Ala.

Quantitative flow at semi-works plant of Bureau of Standards, operated with the backing of the Alabama State Industrial Board, the University of Alabama, and Alabama Polytechnic Institute

100 Pounds of Air-Dried Cotton-Seed Hull Bran; Contains 31 Lb. Xylose

Digest with 530 Lb. of H_2O at 15 Lb. Steam Pressure; Wash with 330 Lb. of Cold H_2O ①

Bran Left in Digester; Digest with 130 Lb. H_2O and 3 Lb. 9 Oz. H_2SO_4 Cold; Wash with 330 Lb. Cold H_2O ①

Extract Wasted Contains 730 Lb. H_2O, 4-6 Lb. Gums and Water-Soluble Ash, and 2 Lb. of Xylose

Bran Left in Digester; Digest with 145 Lb. of Rinse from Preceding Batch + 2 Lb. 15 Oz. of H_2SO_4 at 10 Lb. Steam Pressure

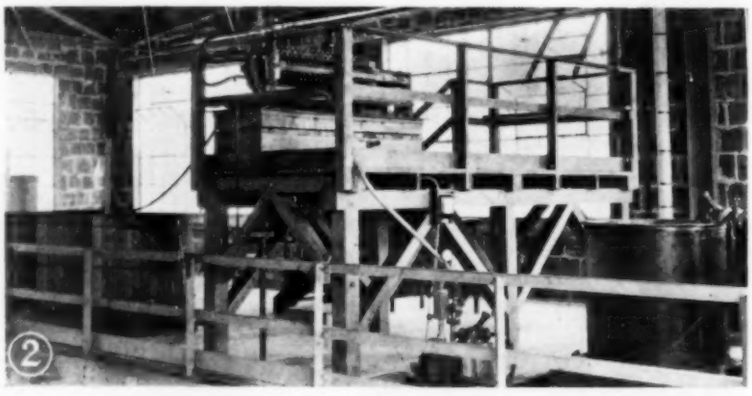
Bran Left in Digester. Wash with 225 Lb. of Rinse from Preceding Batch + 105 Lb. of H_2O Cold

Extract Wasted Contains 460 Lb. H_2O, Acid, Gums, and Ash

Bran Wasted; Contains 50 Lb. Bran, 60 Lb. H_2O and 1½-2 Lb. Xylose

Extract Saved for Digesting and Washing Subsequent Batches; Contains 344 Lb. H_2O and 26 Lb. Xylose

Extract Contains 154 Lb. H_2O and 26 Lb. Xylose



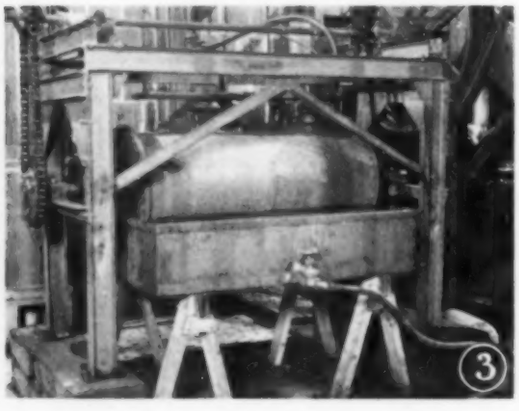
Neutralize to pH 2.8 by Addition of 1 Lb. CaO

Filter and Wash with 16 Lb. H_2O ②

Precipitate Wasted Contains 1 Lb. Xylose

Filtrate: Evaporate 170 Lb. H_2O, to a Sp. Gr. of 1.28

Filter; Wash with 8 Lb. H_2O



Filtrate: Evaporate 18 Lb. H_2O, to a Sp. Gr. of 1.35

Precipitate Wasted; Contains 1½ Lb. Xylose

Crystallize ③

Centrifuge

16 Lb. Mother Liquor Containing 8 Lb. Xylose. Recovery of This Xylose now Being Investigated. Can Be Marketed in Sirup Form

13 Lb. Crystalline Xylose. May Be Purified by Recrystallization

by a wash with cold dilute sulphuric acid. This extraction removed from the bran practically all of the ash and much of the gum and protein constituent, leaving the xylan and cellulose practically unaffected. The washed bran, consisting of these two groups of constituents and some lignin, is then extracted under 10 lb. pressure in a digestor with weak sulphuric acid, of concentration somewhat less than the initial acid wash. After the short pressure treatment in this fashion, the extract contains substantially the chemical equivalent in xylose of all the xylan originally present. This extract is separated by draining from the residual cellulose and is ready for partial neutralization with lime, concentration under reduced pressure, and separation of the crystallized xylose.

The yield of xylose obtained at Anniston has varied with conditions of operation from 13 to 22 per cent of the original dry weight of the bran treated. In addition, a xylose sirup of about 50 per cent sugar content was obtained as a byproduct; this contained from 8 to 12 per cent of the original weight of the bran as xylose, which is accompanied by so much gum and other material as to make its separation as crystalline sugar commercially impracticable as yet.

Apparently the cost for chemicals, heat and power, water and labor in a plant of commercial scale would be approximately 5c. per pound of xylose made. Capital charges on the plant would certainly amount to at least 10c. and might be twice that amount or more, depending both upon the size of the plant and upon the extent to which strictly standard unit machines could be used and the extent to which special types might be required. With generous allowances for capital charges, it seems likely that a commercial plant could manufacture xylose at approximately 25c. per pound, furnishing a product of purity almost comparable with the lower grade of cane and beet sugar marketed—that is, 99 per cent plus. If a large market developed, a cost of 15c. per pound is not beyond the reasonable hopes of an optimistic backer. Such a low price would certainly be realized if a successful development were assured for some of the byproducts of the process, which include gums, potash salts, and a well washed cellulose.

UTILIZATION of xylose as a food sugar would, of course, afford the largest prospective market, but such application seems improbable at the moment. Perhaps xylose has some prospect of successful use by diabetics, who might thereby be able to secure more palatable food without the use of the objectionable six-carbon sweeteners. Medical studies are now being made by a number of interested groups to determine whether the human system can be expected to tolerate these five-carbon sugars, which apparently it does not at all digest. It remains to be seen whether there are objectionable cumulative effects from regular use of these sweetening agents which apparently pass through the system unchanged and are secreted principally in the urine. And, of course, this study must be made both upon human beings in a healthy condition and those suffering from kidney trouble. Pending extensive and thoroughly convincing studies of this sort, the xylose makers apparently must depend altogether on industrial markets for any output that may be developed commercially.

Commercial applications of xylose are under study at scores of places throughout the United States which have been supplied with samples of varying size from the Bureau of Standards experimental plant at Anniston. Incidentally, the Bureau would be glad to furnish additional investigators with adequate supplies of this material for other experiments if they will merely agree to give the Bureau some general information regarding their results sufficient to demonstrate that they have a bona fide and logical interest in this type of research.

BY mild oxidation with nitric acid, xylose is converted to tri-oxy-glutaric acid. This compound is chemically $COOH(CHOH)_3COOH$. In many ways it bears a resemblance to citric acid, apparently being entirely suitable for use in foods and beverages and affording therein a pleasant flavor differing slightly but quite noticeably from citric. Some of the backers of these developments feel that in this food field this tri-oxy-glutaric acid promises to give a whole new group of food products with a welcome variation in flavor. However, investigation is required before extensive application can be suggested in any food material, as the physiological effects of this derivative have not yet been adequately studied.

In several industrial applications—for leather tanning, wool dyeing, and similar applications—the tri-oxy-glutaric acid offers interesting possibilities as a substitute for mixtures of acetic and lactic or acetic and formic. Apparently for the vegetable-tan bath in leather tanning it is practically an ideal substitute for the acetic-lactic mixture now used, as it affords the desired pH value and the other requisite bath characteristics. In wool dyeing it is a substitute for a mixture of acetic and formic.

Nitro derivatives of xylose and of xylite (the glycerine-like alcohol derived from xylose) suggest interesting possibilities in the field of explosives, plastics, lacquers, and the like. A number of manufacturers of nitro compounds already have undertaken studies of this character, and it is an encouraging sign that several of these concerns have come back to the Bureau asking for new and larger lots of xylose to be used on larger-scale studies that seem to be warranted. Fermentation derivatives, such as xylonic acid, or, by selective procedures, propionic or lactic acid, suggest numerous possibilities in the way of making industrial esters advantageously. In view of the almost insatiable demands of lacquer manufacturers for solvents, plasticizers, and various organic compounds, this market is particularly attractive for those who care to undertake this type of investigation.

Xylose itself has as yet been found useful only in a very limited number of industrial applications. One such application is in the making of sirups of exactly the desired viscosity for certain rayon-spinning processes. In this field xylose sirups apparently have certain advantages as compared with those made from other sugars. Xylose is, of course, a potential competitor of any other application industrially of the six-carbon sugars, replacement of which might be feasible if some of the peculiar properties of xylose be found to have important advantages.

In these uses of the sugar itself or of its derivatives it is evident that there remains substantial uncertainty as yet both as to the probable cost and as to the prospective advantage. It seems safe to conclude, however, that xylose offers sufficient advantage that it should be taken into account widely as a potential industrial material of importance. All groups having carbohydrate problems will do well, therefore, to give at least some thought to the possibilities of this entirely new type of five-carbon compound in its relationship to their own developments.

Many Chemical Advances Reported In Atlanta Sessions

EDITORIAL STAFF REPORT

AS REPORTED in *Chem. & Met.'s* news columns last month, Thomas Midgley, Jr., of Dayton, Ohio, held the center of the stage at the Atlanta meeting of the American Chemical Society, April 7 to 11. With characteristic showmanship, he demonstrated the non-flammability and non-toxicity of the organic fluorides, whose use as refrigerants he has recently developed with Dr. A. L. Henne in the laboratories of the Frigidaire Corporation. Mr. Midgley made his demonstration before a large and enthusiastic audience of the Industrial Division of the Society. He filled a large glass beaker with dichlorodifluoromethane, and in another beaker alongside he placed a lighted candle. Through a rubber tube he exhaled into the latter to show that human breath alone would not extinguish the flame. Then he placed his face in the top of the beaker containing the refrigerant and took a deep breath of its vapors. These he exhaled through the tube, as before, into the other container. The candle was snuffed out instantly. The crowd applauded.

Thomas Midgley, Jr.
Ethyl gasoline's discoverer helps to develop new refrigerants

Just a few minutes before Mr. Midgley had read a report from the U. S. Bureau of Mines which stated that although the new refrigerants are practically non-toxic, if taken in large quantities the fumes will produce a queer intoxication accompanied by spasmodic jerking of the muscles. Sobering up, in the case of the animals tested, is quite rapid. Monkeys and dogs breathed a 20-per cent mixture for 7 to 8 hours a day during a 83-day test, gradually developing some tolerance to the gas. The comparative toxicity as reported by the Bureau of Mines from its animal experiments are summarized in the following table:

Refrigerant	Produces Death Quickly	Hazardous to Life in 0.5 to 1.0 hr.	Non-Hazardous to Life After Several Hours
	Per Cent by Volume		
NH_3	0.5–1	0.25–0.45	0.01
CH_3Cl	15–30	2–4	0.5–0.1
CO_2	30	6–8	2–3
CCl_2F_2	Not attainable	80	40

Dichlorodifluoromethane exhibits desirable engineering characteristics for a refrigerant, boiling at —30 deg. C., freezing at —155 deg. C., with a latent heat at 30 deg. C. of 34 cal. per gram. Although it corrodes bronzes and magnesium alloys, it can be handled satisfactorily in equipment of steel, aluminum, tin, Monel metal, and the stainless alloys.

Commercial production probably will not be practical for at least two years. In the meantime, 100-lb. batches have been made in the experimental plant at Dayton, using carbon tetrachloride and dry antimony trifluoride in the presence of antimony pentachloride. Yields as high as 94 per cent have been obtained, with 85 to 88 per cent as the average. Dichlorodifluoromethane shows the possibility of many interesting applications, but probably would replace common refrigerants only where serious hazards to health are involved, such as in inclosed spaces aboard ship, in sleeping rooms, and in mines.

NAVAL STORES received attention in two other papers before the Industrial Division, at which Robert E. Wilson, of the Standard Oil Company, of Indiana, served as chairman. In the first, Brian S. Brown, president of the Georgia Rosin Products Company, of Savannah, traced the history of this Southern industry from the time of Sir Walter Raleigh's first expedition in 1609 to its most recent chemical engineering developments. The introduction of the Herty cup, about 1901, and Homer T. Yaryan's introduction of the steam-and-solvent process, in 1910, are important high spots in the technical history of naval stores in this country.

H. E. Kaiser and R. S. Hancock, of the Hercules Powder Company, discussed the purification of wood rosin. The visible color bodies can be separated from wood rosin by vacuum or steam distillation and fractional condensation. Both the visible and latent color bodies can be removed by washing a wood rosin-gasoline solution with certain immiscible organic solvents, such as furfural, furfuryl alcohol, aniline, and phenol. The use of these selective solvents forms the basis of the commerical process for the production of the finest types of wood rosin. Further research has led to the production of commercial abietic acid and derivatives from wood rosin, all comparable in color to the palest obtained from American gum rosins.

W. D. Munson, of the Southern Chemical Cotton Company, of Chattanooga, reported that 70,000 tons of chemical grade cotton linters were used in 1929. This is about 35 per cent of the total linter production. Lauren B. Hitchcock, professor of chemical engineering at the University of Virginia, stated that cellulose, whether from pulp or cotton, underlies 65 per cent of the chemical processes of Virginia's industry. At present Scandinavian manufacturers of kraft and sulphite pulp undersell domestic producers even in the heart of the Southern pine belt. "The increasing importation through Hamp-

ton Roads of Scandinavian kraft and sulphite pulp," said Professor Hitchcock, "constitutes a challenge to American chemical engineering. Very roughly, 6,000 tons of each variety is received annually for consumption by the Virginia paper industry. In addition, the sulphite spruce for our rayon plants comes almost entirely from Canada."

A recent advance in the Virginia paper industry, reported by Professor Hitchcock, is the use of spent chestnut chips for the production of soda pulp. This development at the plant of the John H. Heald Company, of Lynchburg, will be described in an early issue of *Chem. & Met.*

Five rayon plants in Virginia, employing three of the four commercial processes, now produce 28 per cent of the total consumption of the United States, according to a paper by Robert E. Hussey and Philip C. Scherer, of Virginia Polytechnic Institute.

Walter T. Schriber, of the U. S. Bureau of Standards, told how xylose, the five-carbon sugar, has been produced on a semi-commercial scale from cottonseed hull bran in the plant of the Swann Corporation at Anniston, Ala. This development is described on pages 283-5 of this issue.

Prof. Harry N. Holmes and A. L. Elder, of Oberlin College, discussed the use of vanadium compounds as catalysts for sulphuric acid. By adding potassium metavanadate to a solution of ferric chloride, a precipitate is formed which can be colloidally dispersed by an excess of ferric chloride. Adding this to a sodium silicate solution results in a single precipitate containing the catalyst, promoter and support. The best of the catalysts of this type show a 98 per cent conversion of SO_2 to SO_3, with no decrease in efficiency after 60 hours of continuous use. "The cost of a vanadium catalyst mass," said Professor Holmes, "should not be over 1 per cent of that of a quantity of platinum of equal capacity."

Ruric C. Roark
Conducts symposium on new insecticides and fumigants

Insecticides — fumigants, mothproofing compounds, and contact and stomach insecticides—were featured in an interesting symposium under the chairmanship of Dr. R. C. Roark, of the Department of Agriculture. Ethylene dichloride-carbon tetrachloride, and ethylene oxide-carbon dioxide mixtures which have low toxicity to man, and are without deleterious effects on food products, were shown to be effective in killing insects. Rotenone ($C_{23}H_{22}O_6$), the insecticidal derivative of derris, is being studied by many Government investigators, and at present appears to be one of the most promising internal poisons for insects.

INTER-RELATIONS of the petroleum and gas industries were cited by Gustav Egloff and J. C. Morrell, of the Universal Oil Products Company, of Chicago. Last year 250 billion cubic feet of cracked gas was produced at the refineries. This will eventually serve to supply a substantial portion of the gas of high B.t.u. value required for mixing in the gas plant. Oil cracking plants located near populous centers are already being utilized to supply 1,250-B.t.u. gas for distribution to customers requiring such fuel. In some communities this is mixed with low B.t.u. gas from water gas, blast-furnace, producer, or coke-oven plants. The coke from the cracking process is excellent raw material for making water gas or producer gas, permitting the cracking plant to be used for the production of gasoline, gas, and coke only.

A cracking plant operated in conjunction with a gas plant will supply gas and motor fuel from the various tars, while the petroleum may be used to effect a balance of gasoline and gas production. Egloff and Morrell predicted that the gas plant of the future will be a distributor of anti-knock motor fuels for blending or direct use, and may even manufacture solvents and chemical derivatives from the cracked gas.

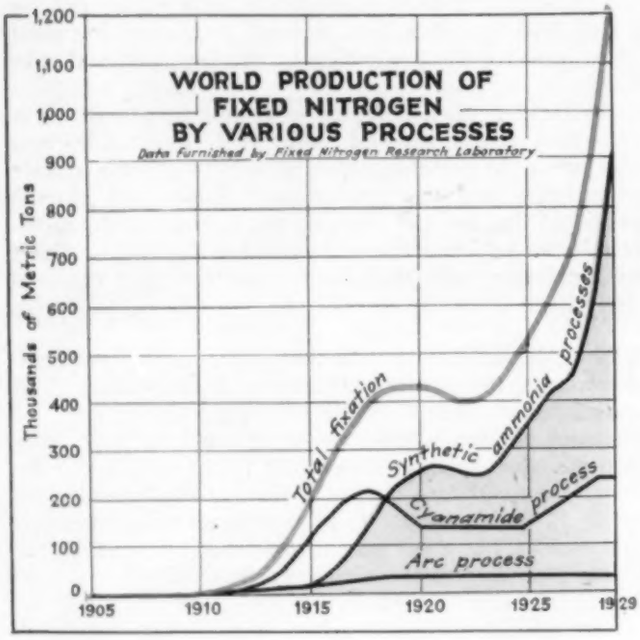
IN CONNECTION with the utilization of waste natural gas, the partial oxidation of hydrocarbons is of considerable interest. This is particularly true of methane, the most important constituent of "dry" natural gas and the most difficult of the natural hydrocarbons to convert into useful products. An investigation by D. F. Smith and R. T. Milner shows the remarkable influence of 1 to 2 per cent of oxides of nitrogen on the reaction between methane and oxygen or air when passed rapidly through hot tubes. Up to 2 per cent of the methane has been converted to formaldehyde per pass in the presence of air or oxygen and small amounts of oxides of nitrogen. The chief reaction usually results in the formation of CO and H_2O, although the efficiency of conversion of CH_4 to CH_2O may be as high as 50 to 60 per cent. Under the conditions investigated, it has been found impossible to recover the nitrogen oxides used, and the volume of gaseous CH_2O found has never exceeded the volume of gaseous NO_2 (or HNO_3) used.

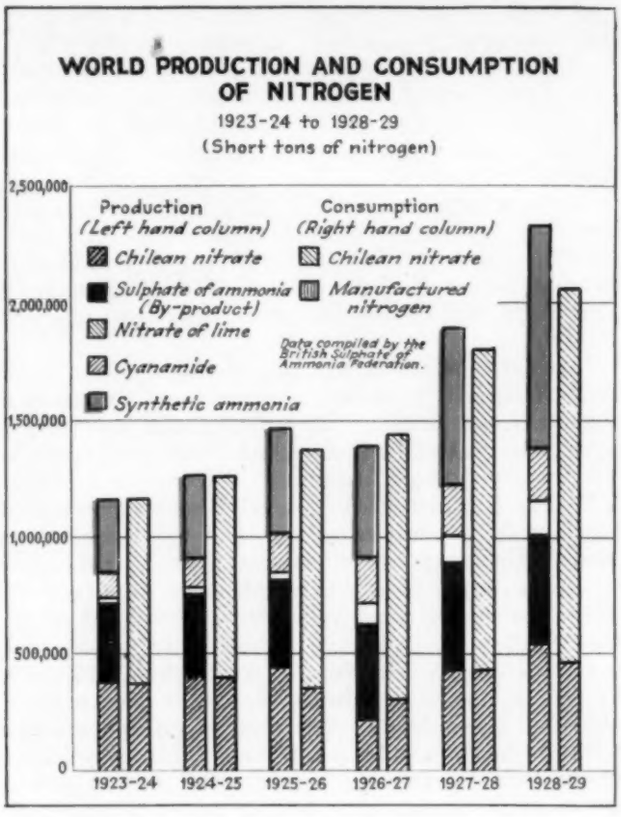
THE EFFECT of mastication, heating in air, in oxygen, in steam, and in carbon dioxide gas, as well as the influence of light upon the plasticity of crude rubber has been investigated by Ernst A. Grenquist, of the Fisk Rubber Company, of Chicopee Falls, Mass. He found that cold milling causes a permanent change in the consistency of crude rubber, whereas heating in air or in steam produces a more or less temporary effect. In the absence of air it seems that the rubber exhibits a maximum amount of disaggregation at each given temperature. At low temperatures the increase in plasticity proceeds with practically the same rate whether the rubber is heated in oxygen or in carbon dioxide. Ultraviolet light affects concurrently both the plastic and elastic properties of the rubber.

The correlation between elasticity and double refraction of crude rubber has been shown. The anisotropic properties of rubber parallel the recovery values. In this investigation there have not been met with any agencies which cause as far-reaching and profound destruction of the elastic properties of the rubber as prolonged physical mastication.

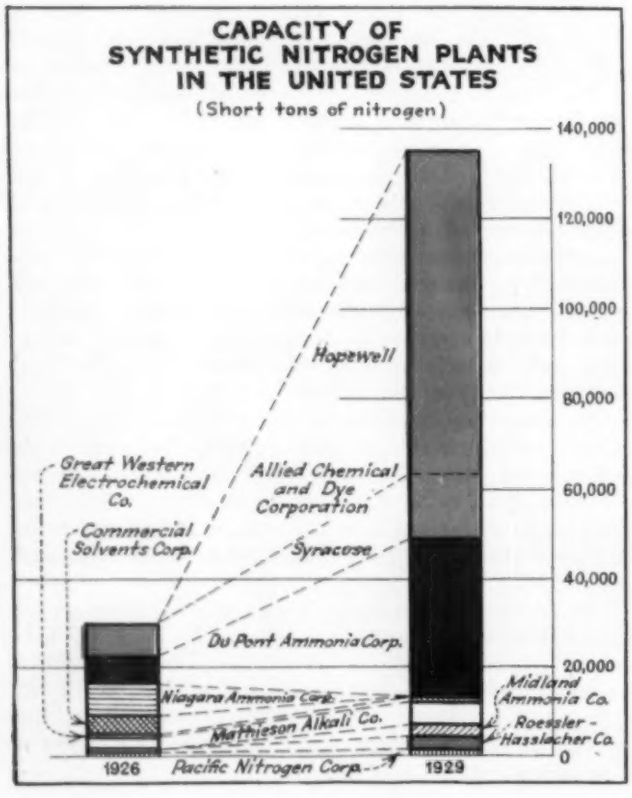
The inter-relation between plasticity and structure of crude rubber has been studied and the fundamental difference between actual mastication and heat break-down has been emphasized. Prolonged milling, heating in air, or in oxygen destroys the protein framework of the rubber. Heating in steam or in an inert gas leaves it more or less intact.

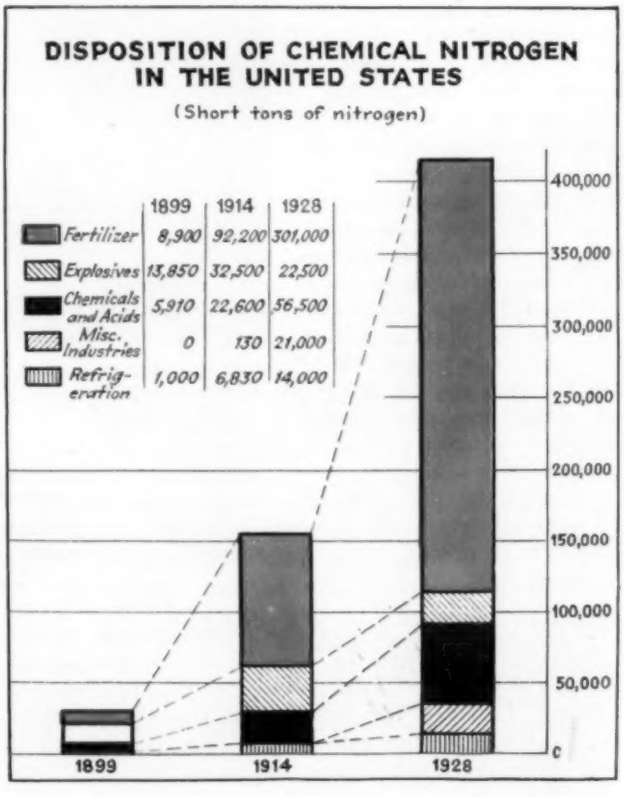
The National Fertilizer Association has issued a memorandum on "Recent Developments in the Fertilizer Industry" in which the importance of fixed nitrogen is illustrated as shown in the accompanying graphs.





Spectacular Rise of Nitrogen Fixation





Wood Storage Yard at the Pensacola Plant of the Newport Company

Producing Naval Stores *From* Waste Wood

By R. C. PALMER

Chief Chemist, The Newport Company Naval Stores Operations, Pensacola, Fla.; Bay Minette, Ala.; DeQuincy, La.

THE TERM "NAVAL STORES" frequently is confusing to those not familiar with this industry. Without going into the interesting historical derivation of the name, it may be stated that naval stores generally means the products turpentine and rosin. Approximately 75 per cent of these materials are produced in the United States by the collection of gum or "oleo-resin" from the living long leaf, Cuban and slash pine during the warm season of the year and the simple physical separation of the volatile constituent, turpentine, from the non-volatile residue, rosin. The balance of the production of these products in this country is derived from the resinous wood waste remaining on the cut-over pine-forest lands. Plants are located in Georgia, Florida, Alabama, Mississippi, and Louisiana. This branch of the naval stores industry, though relatively small in the number of operating plants, has developed from a more or less crude beginning into a highly technical chemical-engineering industry involving a large capital investment.

Raw material is preferably collected from pine-forest lands which have been cut over for a considerable time. Old wood always is more resinous, for the simple reason that it has resisted decay, because of its high resin content. The limbs usually are ready for collecting without any mechanical preparation. Large trunks of trees are reduced to handling size by the axe. The stumps, which constitute 60 to 75 per cent of the total wood waste, are either removed by stump pullers, in which case further reduction in size is necessary to facilitate handling, or the stumps are removed from the ground by means of explosives. If this latter operation is properly done, the material does not require any further reduction.

Wood is transported by wagon, motor truck, or railroad, depending on the proximity of the land being cleared. Relatively large stocks of wood are maintained at the plants, to guard against any interruption of the supply because of unfavorable weather or other unusual conditions. The raw material is bought entirely on a weight basis, instead of the more common cord unit, because of its irregular form. As all pine-wood waste is not acceptable, there usually is some grading and culling, based upon the visible resin content.

The first step in the manufacture is the preparation of the wood for processing. Reduction to comparatively small size is essential for good recovery of products, and this usually is accomplished by a two-stage hogging and shredding operation. This gives a large proportion

View in the Refinery Building

of chips of the splinter type, the largest pieces being approximately ¼ in. in diameter and 1½ in. in length. These chips contain long resin ducts, which is a condition that does not lend itself to the best recovery of rosin, but, in spite of its obvious faults, this type of wood reduction has proved the most economical method. Considerable study has been given to preparing the wood in different ways, such as chipping across the grain, as in pulpwood preparation, or shaving the wood across the grain, and also high-pressure mechanical crushing. The objects are, of course, to insure short resin ducts and secure higher extraction efficiencies.

Prepared chips are conveyed either from storage bins or directly from the reduction machines into the processing vessels. These are tanks or retorts of various size and shape which are provided with steam coils and some means of introducing live steam into the vessel. Chips are held up on a false perforated bottom, below which the live steam enters. The discharge of the spent material may be either from the side or the bottom.

Separation of the bulk of the volatile oil present in the wood by means of steam distillation is the first step in processing. Steam and oil vapors pass out of the top of the retorts to condensers, and the condensate runs to automatic gravity separators. Technical control of the process begins with the steaming step. Steam may be either saturated or superheated, and the operation is conducted under low, moderate, or high pressure, depending upon the results desired. Steaming is continued to a point of steam economy by determining the proportion of oil to water in the distillate. It may be noted at this point that the waste pine wood contains, besides the turpentine, which is the only oil produced by the living tree, other oils which have a considerably higher boiling range; these additional oils come under the class of pine oil. Practically all the turpentine and part of the pine oil are separated from the wood by the steaming operation.

Extraction of rosin from the previously steamed chips is the next step in the operation. The contact with steam serves to heat the wood thoroughly and draws to the surface a portion of the rosin, thus making it available for easy extraction. However, the steam has also sealed the ends of the resin ducts with moisture, which tends to retard further extraction. In one plant the wood is withdrawn from the steaming vessel and passed through a drying operation, and thence to a separate extraction retort, in order to eliminate the moisture. Other plants dry the wood in the steaming retort by various other means.

Counter-current type of extraction is used in most cases. Several extraction units, connected in series, are each in a different stage of the operation, the head one being the latest to be put in cycle and receiving the most nearly saturated extract, while the last one, which has been under extract the longest time, receives a final wash of fresh solvent. There is a wide variation in detail in this operation at different plants, but the general principle is to cook the chips with successive applications of hot solvent until the extraction of rosin is economically complete.

Efficiency of the extraction is governed by a number of factors. These include preparation of the chips, removal of moisture, duration of the operation and volume of solvent employed. It does not necessarily follow that it is most profitable to obtain the greatest yield. Each individual plant has to work out its proper operating balance of efficiency against total output.

The type of solvent has been the subject of much investigation and numerous patents, but at the present time all plants are using some fraction of petroleum naphtha. This type of solvent has the special property of dissolving the largest quantity of true rosin and the least proportion of the non-rosin materials and is, therefore, peculiarly adapted to this extraction. Specifications usually call for the absence of all fractions boiling below 100 deg. C., to minimize losses due to low boiling constituents, and also as little as possible of the fractions boiling above 175 deg. C.

After extraction, the free solvent is removed by either pumping or draining, and the chips are then subjected to steam distillation, as in the first step of the process, to complete the separation. To get the chips free of solvent requires the selection of the proper kind of operation and steam pressure, and these conditions are best worked out experimentally for each installation. Most of the solvent used is recovered in separating the rosin from the extract, and this together with the solvent recovered from the chips is re-used for extraction. In a well-designed plant having good mechanical supervision, the efficiency of solvent recovery is very high.

Oils that are recovered in the primary distillation of the chips consist essentially of turpentine and pine oil in varying proportions, depending upon conditions of steaming. This mixture, called crude turpentine, is the only source of turpentine. Pine oil, however, is recovered from the crude turpentine and also from the rosin extract. Refinement of turpentine consists of chemical treatment and fractional distillation. The chemical action is one of thorough contact with alkali at about 100 deg. C. and may be conducted by agitation with a moderately strong solution of caustic soda or soda ash prior to the distillation, or during the distillation itself. By this

treatment, constituents of unpleasant odor are polymerized and the operation incidentally insures a chemically neutral turpentine. Fractional refinement is conducted either by steam or by dry distillation through special fractionating columns; in the latter case under reduced pressure. The proportion of turpentine of highest purity that is obtainable is a function of the quality of the original crude and the design of the fractionating equipment. Turpentine of guaranteed quality and according to strict specifications is made by careful laboratory and plant control of the operation.

After obtaining the turpentine fraction of the crude turpentine, the distillation is continued to recover the pine oil. Only part of the pine oil is obtained in this operation. The remainder of the pine oil is recovered from the higher boiling constituents of the solvent, and this separation is very similar to the fractional distillation of crude turpentine, except that the lower boiling fractions are not turpentine.

In the refinement of pine oil by steam distillation, the oil becomes water-saturated, and the usual practice is to heat it to approximately the boiling point of water by means of a steam coil, in order to reduce the water content to the usual specification of less than 0.5 per cent. Normal standard steam-distilled pine oil has a characteristic light straw color. Water-white pine oil is made for special purposes by a redistillation of the oil over an excess of alkali under careful control.

The total turpentine oil from the fat pine wood is not all turpentine of the highest quality. A pure turpentine should consist essentially of pinene. Other terpene hydrocarbons, such as dipentene, also are present in the pine wood and may be cut out in the refining of the crude turpentine or separated during the recovery of pine oil from the extract. These terpenes may also be recovered mixed with the higher boiling portions of the solvent, depending on the boiling range of the solvent. These mixed intermediate oils were originally recovered as byproducts in the manufacture of pure steam-distilled turpentine and pine oil, but of recent years they have become standard secondary products of the industry, as they are valuable solvents for special purposes.

Returning again to the extraction process, the rosin extract is delivered hot from the extraction vessel. The quantity of rosin in the extract varies considerably with different operating methods and may be run as low as 40 or as high as 125 lb. of rosin per 100 gal. This extract is first given a preliminary refining in order to remove oxidized resins which are soluble in the hot, but insoluble in the cold extract, and also to separate other foreign matter, such as fine wood dust. The operation in effect produces a cold filtered extract and insures a perfectly clean rosin.

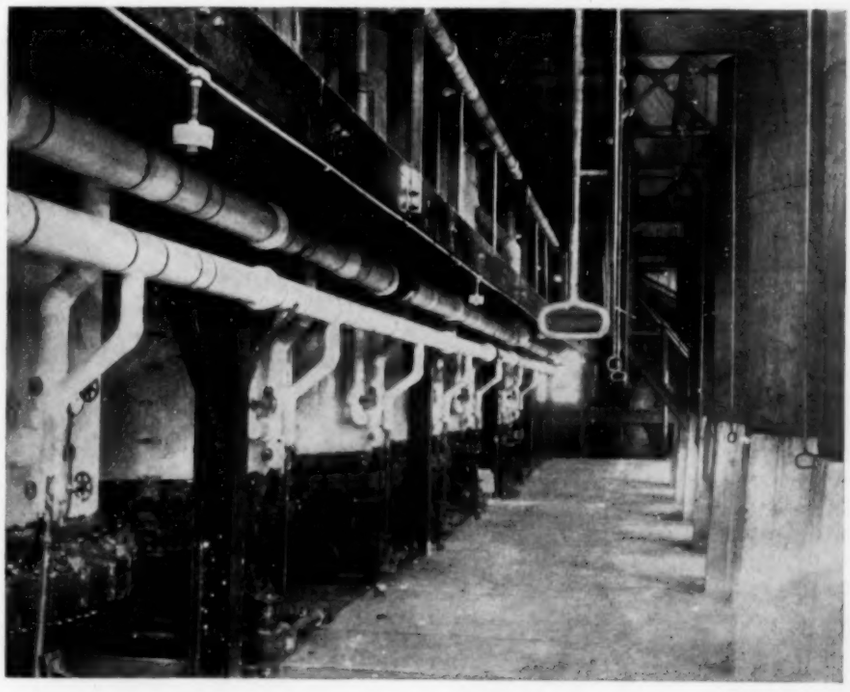
The rosin is then recovered from the extract by evaporation of the solvent. This may be accomplished by dry distillation under reduced pressure in a film-type evaporator or by steam distillation in an ordinary still, or by a combination of these methods. In all cases, however, the finishing or complete removal of solvent and other oils from the residue rosin is conducted under carefully controlled conditions in order to insure a rosin of desired quality. After the complete removal of the solvent, the liquid rosin is then ready for delivery to shipping containers, generally barrels.

Natural wood rosin is of characteristic reddish color, classified by government standards as "FF." As rosins are graded, this is in the dark range. Purification or decolorization of this rosin has been the subject of much research since the inception of the industry. Moderately dark grades of gum rosin may be bleached by sunlight, and this is being practiced in European countries, but not in the United States. The color bodies in wood rosin are not subject to sun bleaching.

THE purification of wood rosin is of such recent commercial accomplishment that full description of the processes employed cannot be given at this time. Mention may be made, however, of some of the methods which have been used in attacking this problem. It was early discovered that the constituents of dark color were of sufficiently higher boiling points than the bulk of the rosin that separation could be effected by fractional distillation at reduced pressure, but the commercial operation is dependent upon economical mechanical perfection of high vacuum distillation. Entirely different methods are based on the discovery that the color bodies of wood rosin form loose chemical combinations with strong acids and, under proper conditions, several salts of metals. These processes require efficient recovery systems for the reagents and involve problems of materials of construction of the equipment.

Other methods of purification have as their basis the fact that when the rosin is dissolved in petroleum solvents a number of organic compounds immiscible with the rosin solvent have a selective solvent action on the dark color constituents. Such selective solvents include aniline, phenol, resorcinol, furfural, and furfuryl alcohol.

Second Floor of Extractor Building at the Pensacola Plant



These processes also require special equipment and the efficient recovery of the selective solvents.

Treatment with adsorbent carbons and clays, a method frequently employed for removing coloring matter from petroleum lubricating oils and certain vegetable oils, has also been found to separate the color bodies of wood rosin. In the case of the rosin, however, the amount of color is so many times greater than in mineral or vegetable oils that a very large quantity of adsorbent must be employed. The success of such methods, therefore, depends on the perfection of processes that will insure a considerable economic re-use of the decolorizing agent.

The production of a variety of special products for specialized uses has been a natural development in the manufacture of the primary products, turpentine, pine oil, and rosin. These modified and secondary products are produced by various physical or chemical treatments. For example, turpentine is the source of pure pinene by additional fractional distillation. Pine oil, which consists essentially of terpene alcohols, is subjected to chemical dehydration to produce unsaturated terpene hydrocarbons, and these in turn may be converted to a variety of polymerized products. Wood rosin is chiefly abietic acid, the proportion varying with the degree of purification. Since the rosin is of an acidic nature, it lends itself readily to combination with metals either by direct fusion with the oxide or hydroxide of the metal, such as the addition of lime, caustic, etc., or indirectly by precipitation in treating the sodium compound with salts of the metals. Limed rosins and rosins containing water-soluble sodium or potassium soaps of the rosin acids are, therefore, readily produced in the course of rosin manufacture.

Laevo form of abietic acid is preponderant in wood rosin. This is known by the fact that its specific optical rotation is near zero plus or minus. This form of acid is less suitable for many purposes than its dextro isomer. Transformation of laevo to the dextro form is accomplished by heating the rosin at moderately high temperature, and this treatment is a special process frequently conducted in connection with the manufacture of wood rosin.

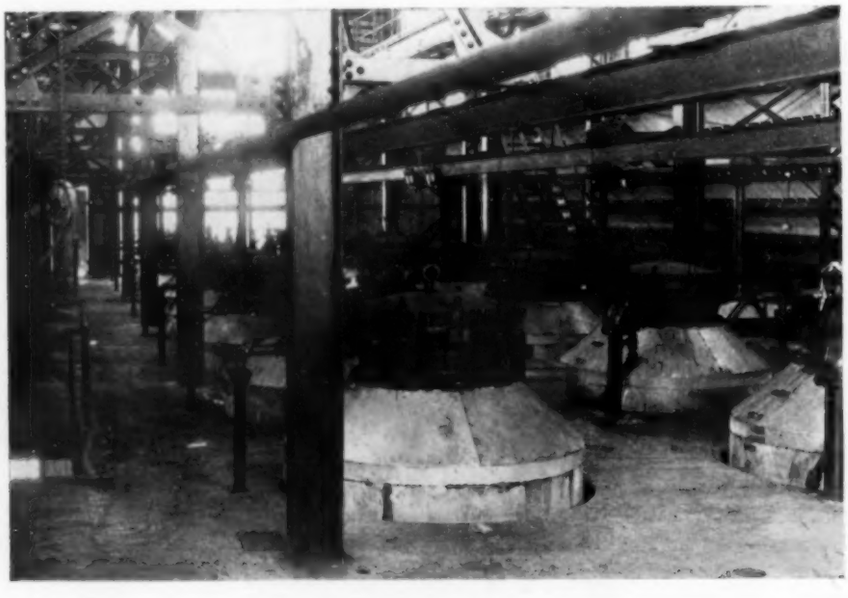
Manufacture of either technical or pure abietic acid also is a natural development in connection with large-scale rosin production. The processes employed involve transformation of the bulk of the rosin to a highly crystalline form and then separating the acid. To produce a pure abietic acid finally requires a fractional crystallization from a solvent.

In a well-balanced operation, the total steam and power requirements can be readily supplied by the extracted wood, and it is used at present at all plants for this purpose. The possible usefulness of this material for some purpose other than fuel has been the subject of much thought and research. One logical field of investigation has been that of kraft pulp, but even though the replacement value as fuel makes it a much cheaper raw material than live wood, the results of studies along this line have so far not been encouraging.

Fibrous products of the general mechanical pulp type constitute another field of suggested utilization with much more promising results. The first commercial unit of such an operation is now under construction at one steam and solvent plant. Chips, upon delivery from the extraction retorts, are first screened to separate dust and dirt, and are then put through a series of fibrating operations and other processes. Resultant pulp finally, in wet condition, is formed into sheets of desired thickness and is then delivered to carefully controlled continuous dryers. The finished material is light, strong, and water resistant. Its high insulating value is an important property, and the first product that will be manufactured will be used chiefly in the insulating field.

Many details necessarily have been omitted from this brief technical picture of a steam and solvent process plant. It also has been impossible to include the many chemical control methods without which the main process and its rapidly increasing secondary processes would not be possible. There has been indicated, however, the general operation now employed by this chemical industry utilizing pine-wood waste as a source of naval stores.

Top Floor of Extractor Building Showing Two Batteries of Extractors



Automatically Controlling Acid Effluents

By H. K. RICHARDSON

Westinghouse Lamp Company
Bloomfield, N. J.

INSTALLATION in the Bloomfield (N. J.) plant of the Westinghouse Lamp Company of equipment for automatically neutralizing acid wastes, has resulted in many economies. Before the operation was made automatic the tanks had to be cleaned once a month, while in the eight months that has lapsed since that time it has not been necessary to clean these tanks. Previously, six hours of a man's time were required daily to care for the tanks, while only two hours is now demanded. While 800 lb. of soda ash was required daily to insure neutral effluent, 20 lb. is now sufficient. Further evidence of the savings due to automatic control is shown by the fact that although the acid consumption has increased 34 per cent, the consumption of limestone has decreased 11 per cent. It has been estimated that the annual saving would amount to approximately $5,000. In addition to the monetary advantages, there is now a visible continuous record of the acidity of the effluent, insuring that no effluent, acid to methyl orange, reaches the river.

Equipment for neutralizing acid wastes and upon which the control devices are now operated was installed several years ago, and has been described by W. L. Sullivan (*Chem. & Met.*, Vol. 35, p. 483, 1928). This original equipment performed satisfactorily until the increased production of the plant strained its capacity, and the effluent often became acid and required the use of soda ash and the entire time of a man to insure that no objectionable liquid reached the Passaic River.

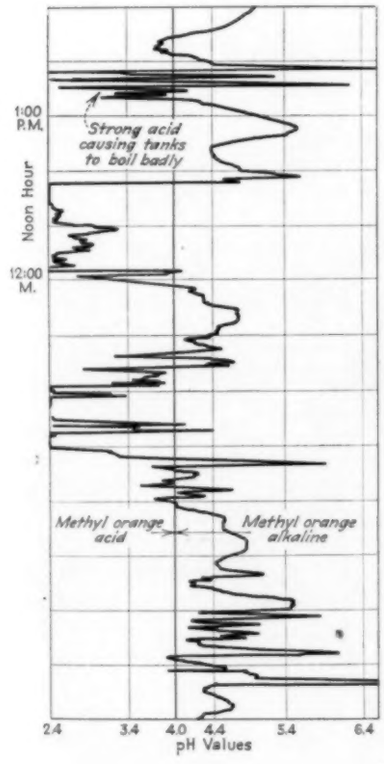


Fig. 1—A Representative pH Record of the Acid Effluent Before Automatic Equipment Was Installed

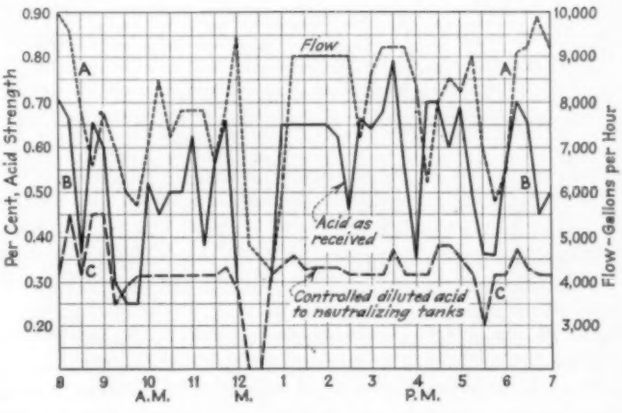


Fig. 2—Curve A-Record of the Flow Meter for the Day; Curve B-Strength of Acid as It Comes From the Dip Room; Curve C-Record of Diluted Acid When the Control Is Properly Working. These Records Were Made on the Same Day

The unsatisfactory working of the tank was due to the high concentration of acid sulphating the limestone, causing: (1) loss of neutralizing power, due to the formation of a cover of calcium sulphate on the stone, and (2) decreased capacity of the system, due to sulphate clogging the flow channels. As a result of this, the stone had to be removed from the tank frequently, resulting in poor stone efficiency and considerable expense.

An investigation of the situation indicated that the tanks would not function properly with acid over approximately 0.3 per cent; therefore it was decided to dilute automatically the dip-room wash water. The instruments installed to accomplish this result include a Leeds & Northrup electrolytic conductivity recorder, which gives a picture of the strength of acid leaving the dip-room wash tanks. This recorder is equipped with contacts which ring a bell in the dip-room when the acid-wash water strength exceeds 0.8 per cent. A second Leeds & Northrup electrolytic conductivity recorder equipped with controls dilutes the raw acid-wash water to the best strength for operating the lime neutralization tanks. Contacts on this instrument operate a motor-controlled valve governing the addition of water to the raw acid-wash water. A hydrogen-ion recorder made by the same company records the pH of the effluent leav-

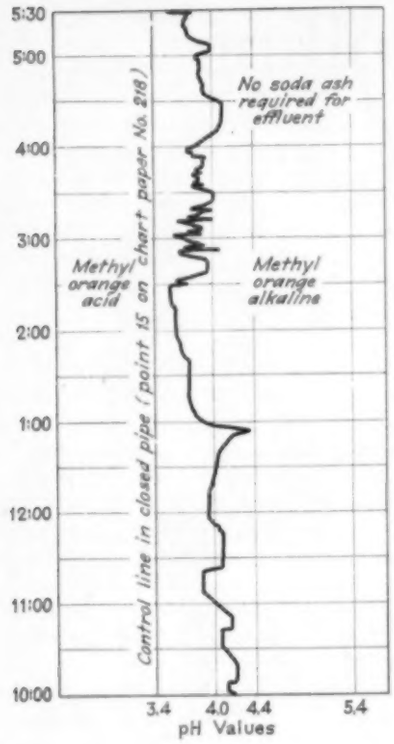


Fig. 3—Record of the pH of the Effluent Going to the Sewer After Installation of the Control Instruments

ing the neutralization tanks. This instrument is equipped with contacts controlling a valve capable of adding soda-ash solution to the effluent in an emergency. A Republic flow meter records the fluctuation in and integrates the total flow of the effluent to the river. The automatic controls used in the system were supplied by the Automatic Temperature Control Company.

Arrangement of tanks as given by Sullivan *(ibid)* was modified by installation of a head tank in which the dilution of the raw waste takes place. This was necessary because the controller ran wild when handling the dilution in a running trough. This tank has served also as a collector of dirt, glass, and sawdust, and has contributed to the smooth running of the main tanks, by keeping this dirt from clogging the stone.

Grief was encountered that is always associated with the adaptation of equipment to a new use. The original glass cells frequently were broken, but a hard rubber cell under development is expected to cure this trouble. The new cell also will embody a more satisfactory method of changing the cell constant than is now used. Conductivity cells are very sensitive to collection of dirt, but no trouble was experienced with those connected with the dilution control, for the rapid circulation at dilution keeps this solution fairly clean. The cells connected to the undiluted acid recorder were always clogging, due to scum, soap, or sawdust entering them. These cells are housed in a large glass tube, through which a small sample stream is constantly flowing to the sanitary sewer. A perforated Nichrome screen of special design protects the inlet to this stream.

The original type of pH cell required the addition of quinhydrone once a day. It also clogged once or twice an hour. This difficulty came from the dropping of Ca SO_4 and iron hydrates in among the tablets of quinhydrone and stopping the flow. The quinhydrone is now added in a large flask with a sieve bottom separated from the half cell. This bottle holds nearly a week's supply of the chemical and seldom clogs entirely. It is still necessary to watch the chart and to free the channel by squeezing the rubber tube; this happens perhaps once a day now.

As at present set the point at which the effluent turns methyl orange, red when the hydrogen-ion cell is clean is 15 on Leeds & Northrup chart paper No. 218, which was used for this record. This corresponds to pH 3.4. This point gradually shifts to 11 on the chart, corresponding to pH 3.1. The shift is due to the gold electrode getting dirty, probably from the slight quantity of soap carried down with the wash water. Taking the electrode out and cleaning it is a matter of ten minutes' time. When replaced, the end point returns to its original position, 15 on the chart. This cleaning is necessary once a week. A drift of this extent is not serious, for an ordinary analyst cannot check himself to within 0.3 pH on the methyl-orange end point. The effect of the usual temperature changes is 0.2 pH. Furthermore, the drift is such that the resulting effluent always is more alkaline than the record. The 0.5 pH drift at this concentration results in an acid concentration change of 0.003 per cent.

The constancy of the pH record for methyl orange was a matter of controversy. In a solution with small salt concentration and no carbon dioxide dissolved, the methyl-orange end point is pH 4.2. When measuring the pH of the effluent under various conditions it was found that the quantity of dissolved carbon dioxide influenced the millivolt readings. The readings varied with the length of time the solution had stood and the amount of stirring it received. No completely satisfactory explanation was obtained regarding this change. Later, when the effluent was sent to the river through an 8-in. pipe, rather than through an open trough, it was found that the methyl-orange end point stabilized itself at pH 3.4. This probably is due to the fact that no CO_2 can escape from the solution until after the

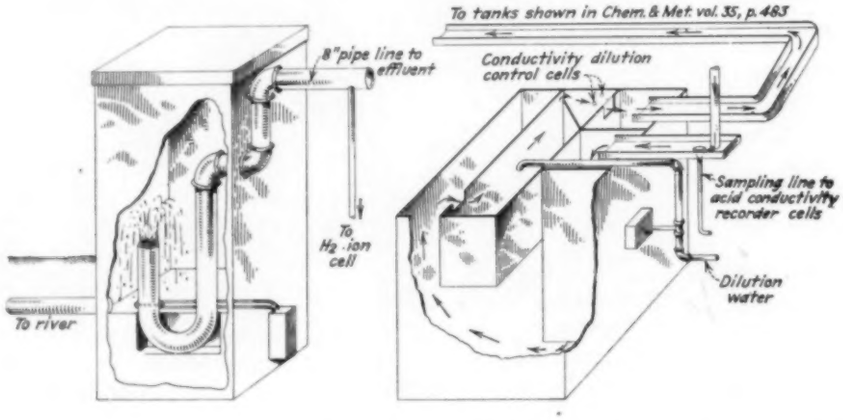

To tanks shown in Chem. & Met. vol. 35, p. 483
8" pipe line to effluent
Conductivity dilution control cells
Sampling line to acid conductivity recorder cells
To H_2 ion cell
Dilution water
To river

Fig. 4—Arrangement of Head Tank and Position of Instruments

nydrogen-ion recorder-sampling line is passed. Since this point is now stabilized and drifts only as noted above, 15 on the chart is now the working methyl-orange end point regularly used.

The first work required of the instruments after installation was a record of conditions then existing. The instruments were not all installed at one time, arriving at intervals over eight weeks; therefore, while the charts represent original conditions, they were not taken at the same time. Also, the calibrations of the instruments were changed as the work progressed. The acid strength of the wash water varied from moment to moment, and the variation from day to day was great. A representative pH record of the acid effluent before installation of controls is shown in Fig. 1. Acid excursions were neutralized by soda ash, 1,100 lb. being used during the day this record was made. Due to the necessity for keeping the effluent neutral, no record of what the neutralizing tanks were accomplishing is available. No record is available as to how the acid went to the tanks after dilution.

Present conditions with controls operating can be judged from Figs. 2 and 3, all of which are from the same day's run. Curve *B*, Fig. 2, shows the strength of acid as it comes from the dip-room. The operators keep the solution below 0.8 per cent acid, as they dislike to hear the bell ring. A record of the diluted acid when

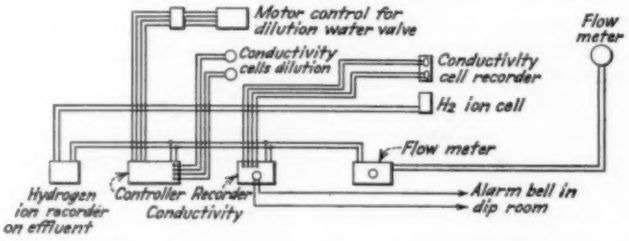


Fig. 5—Electrical Connections of the Numerous Instruments

the control is properly working is illustrated by curve *C* in Fig. 2. This instrument is extremely sensitive. The controller keeps the acid to the tank at 0.315 per cent plus or minus 0.020. High acid values between 8 and 9 a.m., 3 and 5 p.m., and 1 and 2 p.m. are caused by more pounds of acid coming down to the tanks than there is water for dilution available. At such times the water valve is entirely open with the apparatus vainly trying to control. A record of the pH of the effluent going to the sewer is shown in Fig. 3. The danger point is 15 on chart paper No. 218 referred to above, below which the effluent will turn to methyl orange, red. No soda ash was needed this day. A discussion of the variations in the pH of the methyl-orange end point has been referred to previously. Curve *A*, Fig. 2 shows the record of the flow meter for the day that curves *B* and *C* were obtained. A total of 117,000 gal. of 0.315 acid was handled by the tanks this day, requiring no soda-ash neutralization of the effluent.

It is evident that the installation of the automatic controls has resulted in increased satisfaction in the use of the old neutralizer tank. The limit of capacity of the apparatus is approximately the neutralization of 270 lb. of acid per hour—i.e., 10,000 gal. of 0.325 per cent acid or any multiple of gallons times per cent acid that equals 3,250. To handle the present wash water properly requires additional water for dilution, but steps are being taken to change the process so that less acid will be lost

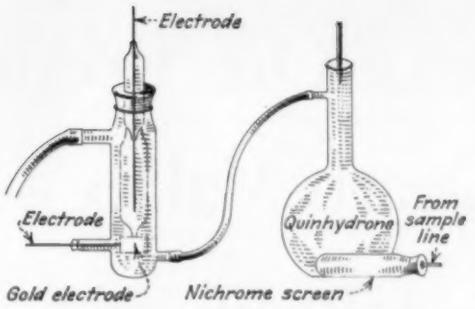


Fig. 6—Quinhydrone Is Added in a Large Flask With a Sieve Bottom Separated From the Half Cell

in the wash water. The usual time of contact of the acid with the limestone appears to be 25 minutes. If the rate of flow of the diluted acid is too great, the effluent becomes acid. In one case, the time of contact was only 15 minutes, due to an unusual rush of dilution water. In spite of the low dilution, the effluent was acid and stayed so until the flow was brought below 10,000 gal. per hour.

The Passaic Valley Sewer Commission was loath to set a pH value to which the effluent should correspond, preferring not to change from the methyl-orange criterion. Since the controls have been operating, no complaints have been received from the Commission.

Since the main body of the work has been completed, development of a cell supplying quinhydrone in liquid form has made possible the handling of alkaline solutions; therefore, soapy wastes which are sometimes alkaline and destroy quinhydrone, can now be neutralized automatically.

Adjustment of the instruments was accomplished with the co-operation of M. B. Barba and R. K. Davis, of Leeds & Northrup; W. Goehring, of the Automatic Temperature Control Company; and G. S. Hendrickson, of Republic, to whom acknowledgment is made. The practical working out of the problem is due, mostly, to the painstaking care and suggestions given by F. N. Newcombe, factory engineer of the Belleville Base Works, Westinghouse Lamp Company.

High-Temperature Steel

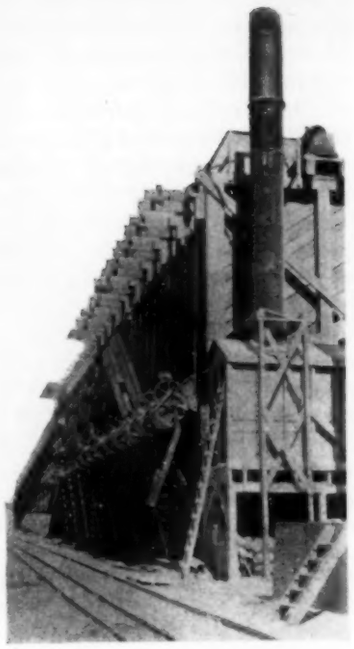
THE calorizing process (surface alloying of a mild steel or like metal with aluminum), according to B. J. Sayles, in the November issue of *Brass World*, greatly increases the resistance of the metal to oxidation at high temperature. It thus admits the relatively inexpensive ferrous metals to fields of high-temperature use, from which they were formerly barred by their susceptibility to oxidation. Incidentally, it makes the metal resistant to corrosion by hot sulphur compounds, such as occur in flue gases and petroleum distillates. For this reason, calorized tubing or sheet finds some of its major uses in cracking stills in the petroleum industry, and in parts for industrial furnaces. These parts include pipe coils for air heaters or recuperators, carburizing boxes, furnace doors, door frames and the like, where high strength or rigidity and long life under severe conditions are wanted.

Test results are reported for 20 metal products in pressure cracking stills, showing aluminum, duralumin, Calite castings, and calorized plate as the only ones which completely resisted oxidation and sulphur corrosion.

Borax Ore Preparation in Death Valley—

A Reminiscence

By H. L. GLAZE
Consulting Engineer
Los Angeles, Calif.



Ore Cars Were Hauled up the Trestle and Dumped Into These Bins. In the Foreground Is Part of the Dust House and Its Exhaust Stack

SINCE THE DISCOVERY of "Rasorite" at Cramer, Calif., the Pacific Coast Borax Company has discontinued the mining and dressing of borax ore at Death Valley. This has been occasioned by the shorter haul involved in the case of the new operations and because of the fact that the newly discovered ore is much more cheaply treated in the subsequent refining operations at the seaboard refineries at San Pedro, Calif., and elsewhere. The treatment of the older ores, colmanite and ulexite, which were formerly mined at Death Valley was carried out at Death Valley Junction, on the Tonopah & Tidewater Railroad about 3 miles from the Nevada line in California. This plant, of considerable size, was one of the outstanding industries of the desert, and its passing completes another chapter in the colorful history of borax.

That the industry could support several hundred families in the most barren and desolate spot on earth, and house them in a camp which was the ultimate in desert architecture—with its patio, its air washers, its motion picture shows—speaks volumes for the care which the Borax company gave its employees. Shades of the immigrants! These gentry, if they could return, would feel amply repaid by one view of the modern steam-heated, ice-cooled apartments which have sprung up on their old trail in the Armagosa, even though their return meant to die again in the middle of the desert.

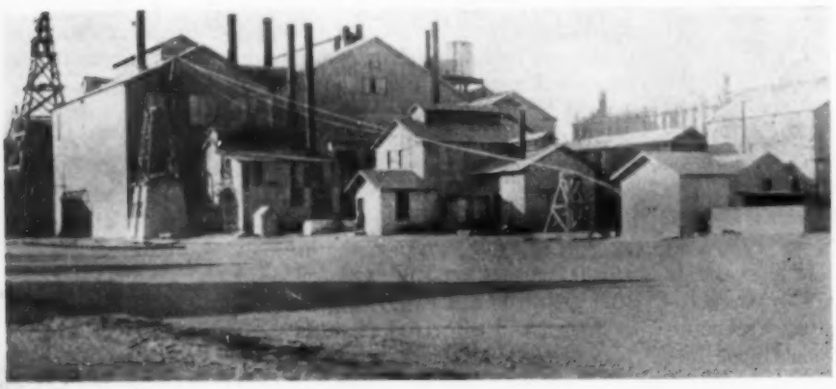
But even now the plant has not been completely abandoned, although its job today is the prosaic business of drying and grinding clay for the treatment of petroleum products. This is a clay which is mined near by at Ash Meadows, Nev.

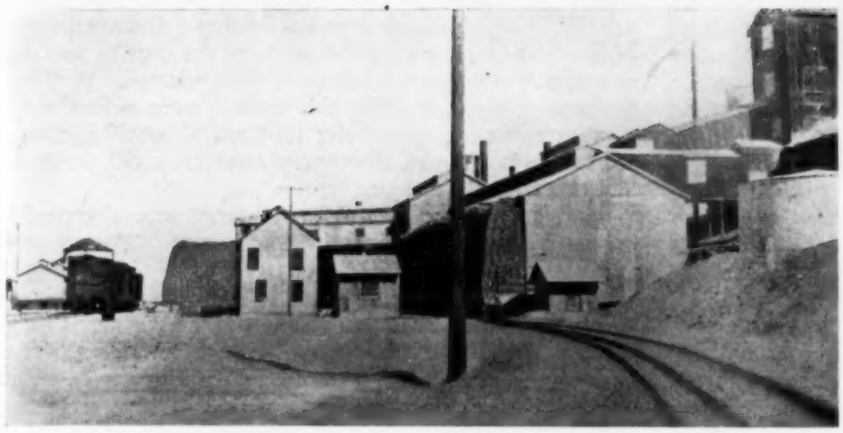
Several interesting and somewhat unusual unit operations were involved in the processing of borax at Death Valley. The writer's connection with this plant began in 1920, when he was retained by the Stebbins Engineering Company, of Los Angeles, to design and construct a dry concentrating mill for removing shale from flour borax. The completed unit was worked into the general process, all of which is to be described in what follows.

Ores treated in this plant consisted of colmanite, a borate of lime; and ulexite, a double borate of lime and sodium. These ores were mined at Ryan and Lila C, on the eastern edge of Death Valley proper, and brought to the plant by narrow-gage steam and gas locomotives and dump-bottom cars. Ores came to the plant mixed with much of the country rock, which is a fairly hard shale, although considerable colmanite was sorted out at the mines in a pure form requiring no preliminary treatment, and transferred directly from the narrow-gage to standard-gage cars at the Junction for shipment to the refineries. Those ores which were unsorted, however, constituted the feed of the plant and their treatment involved the separation of the borates from the accompanying shale.

Raw-ore and shipping bins for the pure colmanite were located under a railway trestle which carried the narrow-gage trains from the mines. Ore was dumped directly into the bins and was later given two reductions, first in a gyratory crusher and then in a set of rolls to which the former discharged. The output was about $\frac{3}{4}$-in. maximum size, and was carried, without attempt at classification, by a belt conveyor and elevators to elevated steel tanks over the calciner feeders. From here, the crushed ore was fed into the calcining furnaces by means of automatic, variable-speed feeders. The six oil-fired furnaces, each about 7 ft. in diameter and 50 ft. long, of special design patented by the Borax company, were of double construction, consisting of an outside firebrick-lined steel shell inside of which

View Showing Large Calciner Building in Background; Power House, Supply Room, and Machine Shop in Foreground; Ore Bins, Crusher House, and Dust House at Right





Shipping Warehouse at Center, Old Wet Mill at Right and New De-Shaling Plant at Left Center; Death Valley Depot Appears at Extreme Left

was suspended another shell of cast iron through which the ore was passed. Combustion took place between the shells, out of direct contact with the borax, while the ore itself entered the inner shell at the upper end, traveled through because of the slight incline, and discharged at the lower end through a movable fire hood, much like those used on cement kilns.

During its calcination, the colmanite lost its water of crystallization and fell to a powder. Shale, on the other hand, was unaffected by the temperature of operation—about 900 deg. F.—and, like the ulexite, which also was little acted upon by the heat, was discharged still in its original lump form.

In order to remove the vapor given off by the colmanite in losing its water of crystallization, a fan blast was necessary which, unfortunately, also removed quantities of dust containing considerable borax. Pipes leading to the fans were egg-shaped and were provided with screw conveyors to remove the heavier dust which settled and carry it to a sacking bin in the warehouse. The pipes were large enough to maintain a low velocity, with the object of settling as much of this dust as possible. What dust was recovered was packed for shipment, although it was of fairly low grade—about 18 per cent anhydrous boric acid. There was not a great quantity of it and it was cheap to pack.

All dust which was not settled in the flues was blown into a long dust house containing many baffles which served to settle the dust. This dust also was of low grade and small quantity, but it was very expensive to handle, as it tended to solidify in the bins and had to be dug out by hand. Various attempts were made to devise means for continuously removing it from the dust house, but the presence of small quantities of sulphuric acid, resulting from decomposition of the gypsum in the ore, caused corrosion which was too severe for ordinary mechanical devices. Corrosion was serious only where the dust and gases were allowed to cool, as in the case of the dust house. An electrostatic precipitator was tried out at one time, but proved unsatisfactory on this particular problem.

Returning to the mixed product from the calciners, we find this carried by screw conveyors to bumping screens, of which there was one for each calciner. Here the ore was separated into two portions, one called "flour borax," which passed through the twenty mesh screens; and the tailings, consisting of shale and ulexite. A good deal of shale and ulexite passed through the screens and reduced the quality of the flour borax, which was at that time the chief finished product of the plant. It was principally to improve this product that the writer later built the de-shaling plant to produce a flour of much higher grade and a tailing consisting of a very lean, fine shale.

Tailings passing over the screens traveled by screw, elevator, and belt to a storage bin over the tailings dump. Distribution from the bin was by hand-propelled dump cars, which later were called upon to move a part of the tailings, as fast as they could be treated, to a wet concentrating plant. The latter, however, was never able to keep up with the supply and an immense accumulation of tailings resulted during the years of operation before the concentrating plant finally burned down.

Reverse concentration was necessary in treating the tailings, as the ulexite is lighter than the shale. In fact, all the concentrating operations carried out on borax are of this category. In the old wet concentrating mill, the tailings were reclaimed by hand with dump cars from the pile, elevated to a feed bin at the top of the mill, fed automatically into rolls and reduced to a maximum size of $\frac{1}{4}$ in. The roll product was classified in a trommel screen of about twelve mesh, the coarser product passing to jigs and the fines to Wilfley tables. These were very hard to operate because of the reverse concentration and the small difference in specific gravity between the shale and the calcined ulexite. Other disadvantages included a heavy labor requirement and the drying that was necessary for the concentrates. Drying was first accomplished on steam-heated floor plates. Later, however, a mechanically-operated, steam-heated,

Stebbins Dry Concentrators Installed Within De-Shaling Plant

plate dryer was constructed which operated in conjunction with a Ruggles-Coles rotary dryer from which the concentrates were elevated and screw-conveyed to sacking bins in the shipping warehouse.

After the fire, a dry concentrating plant was installed by the Stebbins Engineering Company. The new equipment was able, before the final closing of the plant, to work up all of the accumulated tailings, as well as the regular tailings output from the calciners. The new plant was of modern steel construction and consisted of a feed bin receiving ore by belt conveyor from the calcining plant, pneumatic classifiers invented by A. H. Stebbins, roughing dry-concentrating tables for coarse ore, finishing dry tables for the same purpose, and dry dust tables for handling the fines. The concentrates from all of these tables were conveyed directly to the shipping bins as with the old wet mill; and the barren tailings were conveyed to the final tailings pile by a belt.

SAVINGS effected by the dry mill were substantial, for labor cost was much lower and the drying operation was eliminated entirely, as was the pumping and storage of water. On the other hand, water was not difficult to obtain at Death Valley Junction, for a good supply of shallow water lay under the property.

All of the flour borax which passed through the bumping screens following the calciners was carried by screw conveyors and an elevator to the sacking bins in the shipping warehouse. Here the flour was packed into large sacks holding about 100 lb. each for shipment to the refinery. These sacks were of very heavy construction and were used over and over again. Their first cost, repairs, and freight were a serious matter and their later elimination, through use of the de-shaling plant built by the writer, resulted in a considerable saving.

A more important result of the de-shaling plant, however, was the increased quality of the borax shipped to the refinery and the saving in freight on the shale which was removed. The new de-shaling plant was erected near the shipping warehouse and was served by conveyors for bringing in the feed and taking back the concentrates to the shipping bins. The de-shaler tailings were mixed with water and the mixture was conveyed by means of a sand pump to various parts of the property where it was desirable as a filling material, in view of its characteristic of setting fairly hard as it dried out. This de-shaling plant itself worked continuously until operations at Death Valley were finally discontinued and during its period of usefulness saved hundreds of thousands of dollars in freight and sacks.

Feed for the de-shaler, as has been mentioned, consisted of the flour borax screened out following the calciners. It was taken from a screw conveyor near the shipping bins, run over an air classifier to take out the very light, high-grade dust, and the remainder passed by a screw to the feed bin of the Stebbins dry concentrators. Dust removed by the classifier was carried by a fan to a cyclone separator and air filter and was discharged into the shipping bins. On the ground floor of the de-shaling plant were twelve dry concentrators especially designed for the service. Three screw conveyors operated under the 12 tables, one carrying tailings to an elevator feeding the mixing tank of the tailings pump; one carrying the completed concentrates to an elevator and a second screw, and then to the shipping bins; and the third conveyor returning the middlings, by means of an elevator, to the table feed. The original plan to return the middlings to the raw ore feed of the calciners, while excellent in theory, was unsuccessful in practice, as the fan picked up all of the middlings with the dust and deposited them in the dust bin, lowering the grade of the dust to such an extent that the practice had to be discontinued. Without re-roasting the middlings, the savings were nevertheless very satisfactory. De-shaler feed ran about 38 per cent anhydrous boric acid, the concentrates about 50 per cent, and the tails about 4 per cent.

The entire plant as outlined above was electrically driven by individual motors throughout. Power was generated by two Diesel engines of 275 and 500 hp., running on fuel oil. The writer was much impressed with the performance of these engines, operating, as they were, under the most adverse of desert conditions. The first engine established a record for continuous 24-hour operation under overload for a period of several years, with no shut-down of any consequence during the period.

That unknown world which lies around the next corner is always attractive. Much involved in the construction of this plant was around that same next corner, for data on dry concentration were not to be had. Every credit is due to the Borax company for its forbearance in the face of the numerous difficulties with which this development was surrounded, and for its cheerful provision of money for engineering and research. Much credit also is due to A. H. Stebbins for his years of unrewarded work in the field of dry concentration. In this writer's opinion, such a form of classifying and concentrating can and will be used in the solution of many problems where wet methods are now used, and again in others where no other method is successful.

Work on Properties of Diphenyl Now Completed

ANNOUNCEMENT has just been made by the Federal Phosphorus Company division of The Swann Corporation, Birmingham, Ala., of the completion of work on the physical properties of diphenyl. It is understood that copies of a report on these properties are available for distribution.

Hardly more than a year ago diphenyl was known only in the laboratory and was valued at about $40 per pound. One of the large oil companies found that the material had decided advantages for certain applications in high-temperature heating. At the request of this company, Federal Phosphorus Company undertook commercial production of diphenyl with the result that it is now available in carload lots at about $0.30 per pound.

Publication of the properties of diphenyl is the culmination of work which has been under way for some time by the Phosphorus company and by a number of other investigators in the laboratories of the University of Michigan, Massachusetts Institute of Technology and Georgia School of Technology. Work is being continued to determine accurately the limiting temperatures for which this material may be used, although work to date shows that it is stable at 850 deg. F. and probably as high as 900 deg. No evidence of its attacking cast iron or steel at these temperatures has been found.

Commercial diphenyl has a melting point at atmospheric pressure of 157 deg. F., a boiling point of 492 deg. and a critical temperature of 980 deg. As an example of its property of permitting high temperatures at pressures much lower than steam, temperature of 700 deg. at a pressure of 95.4 lb. gage may be cited.

Making the Steel Equipment Dollar Go Further

By FRED D. HARTFORD

Chief Engineer, Burkhardt & Sons Steel & Iron Works, Denver, Col.

The plant experience that gives Mr. Hartford's comments on equipment economies an especial interest was gained in his work with the Western Chemical Manufacturing Company and General Chemical Company between 1915 and 1927. Mr. Hartford had previously received his engineering degree at the University of Colorado and is charged by his present company at Denver with the directive care of its engineering problems.

ROLLED STEEL enters into the construction of chemical equipment more than any other material. Particularly in the field of heavy chemical manufacture is it supreme. The principal advantages of steel are these:

1. Low cost.
2. Resistance to temperature and to many corrosive substances.
3. Strength and rigidity.
4. Readiness with which it can be fabricated.
5. Numerous shapes, thicknesses, and sizes readily available from stocks in almost every city.
6. Many shops available for its fabrication.

The occasional unsatisfactory service of steel in chemical equipment, either as to cost or as to life, is likely to be the result of improper design rather than of unsuitability of material. The purpose of this article is to point out certain factors leading to its economical use.

In order to take full advantage of steel's good qualities, the designer must be familiar with shop practice, so that the necessary thickness and stiffness of the various parts may be provided without undue cost. Likewise, he should specify the use of stock materials unless there are very good reasons for employing special weights or sizes. Finally, in order to obtain competitive prices he must show by his drawings and specifications just what he requires—not only the sizes of material but also the methods of fabrication, the type of joints, and details of the auxiliaries. The following discussion applies to closed and open tanks, blowcases, tank car tanks, filter vessels, and the like. It does not apply to vessels which must resist high pressure and elevated temperatures.

Designing for Economy

Although it is well for the designer to keep in the background of his mind the fact that, for a minimum interior surface exposed to corrosion or radiation, the sphere, the cube, and the cylinder with the diameter equal to the length are required, he should know that numerous other factors enter into the construction of the most economical equipment. Stock sizes of rolled steel should be used whenever possible. Plates up to 144 in. wide by 40 ft. long may be purchased, but their cost is somewhat higher than narrower sheets; furthermore, very wide sheets must be rolled to special mill order, a circumstance which may incur several months' delay. The "stock lists" published by fabricating plants and steel warehouses usually indicate that plates varying by sixteenths up to $\frac{3}{4}$ in. in thickness, and in width by single inches up to 12 in., by 2-in. intervals from 12 to 30 in., by 6-in. intervals from 30 to 60 in., and by 12-in. intervals from 60 to 96 in. may usually be obtained. Shapes, such as angles and beams, in at least the lightest and one intermediate weight, are available in 60-ft. lengths, sometimes 80 ft. When odd sizes, which must be cut out of larger pieces, are specified, then fabricating shops usually charge not only for the larger piece but also for the work of shearing or sawing.

Shipping dimensions and weights of single pieces are important. Where truck shipment is possible, dimensions up to 20 ft. in diameter by 20 ft. high are possible. Thus, a local shop using truck delivery can sometimes underbid the distant shop which, forced to limit the sizes of single pieces to railroad clearances, must provide additional splices that require riveting or welding in the field. Shipping dimensions apply particularly when equipment must be sent by rail, and weight limitation is a factor in truck shipment.

Spherical or specially deformed shapes for tank tops or bottoms cannot be cheaply made in many shops. A pyramidal or a conical form usually is just as satisfactory and has the advantage of easy and rapid fabrication in the ordinary shop.

Average Shop Limitations

Specifications commonly require that the diameter of punched holes must not exceed the thickness of the material, and that the diameter of the hole in the die below the punch must not exceed that of the punch more than $\frac{1}{8}$ in. These limitations aim to prevent too violent distortion and cold working of the metal and to avoid a too frustum-like shape of the punched hole. On very high-grade work, drilling usually is required. A compromise between drilling and punching, which produces superior results at low cost, is to specify holes subpunched $\frac{1}{8}$ in. less in diameter than the finished hole and reamed to the full size after assembling.

Whenever possible, riveted parts should be arranged

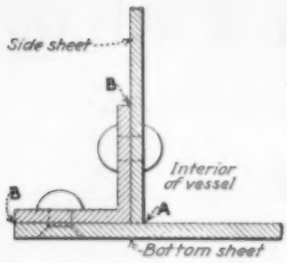


Fig. 1—Type of bottom corner joint difficult to make tight unless welded at A. Calking at points B not satisfactory except for low pressures.

so that a riveting machine may be used. It has been found that for joints to resist pressure, the rivet driven by a pneumatic hammer is not so satisfactory as the one which has been pressed into shape and allowed to take its shrinkage while the pressure of the machine is holding the parts tightly together. No loose rivets should be tolerated on chemical equipment. It is particularly desirable to keep the number of sizes of rivets a minimum — one, if possible. Defective riveted work usually can be traced to badly matched holes, and the failure to remove burrs, mill scale, or rust, which prevent the parts being tightly drawn together.

The average steel shop can rarely shear a plate over 72 in. wide, and often 48 in. is the limit, hence wider plates are either burned across and then trimmed by hand or, if only the edge need be cropped off, can sometimes

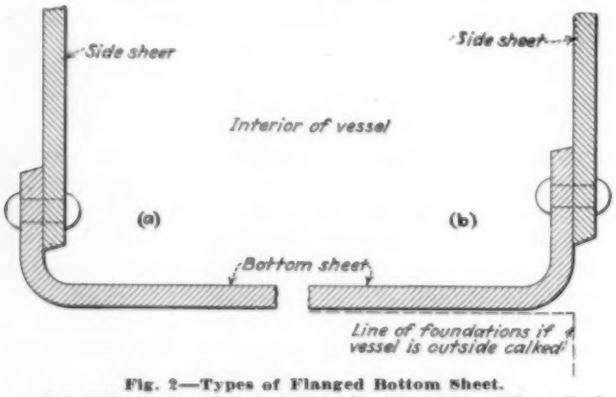


Fig. 2—Types of Flanged Bottom Sheet.
(a) Difficult to calk on inside. (b) Can be readily calked on either or both sides.

be fed sideways along the shear. Therefore, when a piece of equipment calls for a considerable amount of plate work, it will be well to keep the width of plates 72 in. or less. The same principle applies to bevel shearing for a calked edge. The average shop cannot shear a plate over $\frac{3}{4}$ in. in thickness, nor over 30 sq.in. in total cross-sectional area.

Comparatively few shops in the country can roll plates such as are required for the bottom sheets of tank cars. Accordingly, unless the equipment requires special rigidity or a minimum of joints, rolled plates more than 72 in. in width should not be specified, and 48 in. usually is better. In the case of rolled angles it is well to limit the radius of curvature to not less than six times the width of the leg of the angle; considerably more is preferable. If rolled angles are to be milled off to make a flanged joint, at least $\frac{1}{8}$ in. should be allowed for machining.

Since corrosion of steel plates is accelerated by cold working or violent distortion, specifications should require all flanging to be done hot.

Thickness of Various Parts

Knowing the rate at which corrosion of steel takes place in a given piece of equipment, and knowing its expected length of service, the designer can decide on the thickness of material. To this "service" thickness he should add an amount necessary to provide for pressure head and for resistance to crippling. If the vessel has large flat surfaces, then resistance to pressure and crippling can be more economically provided by stiffening ribs than by increasing the metal thickness. If the vessel is exposed to fire gases, the stiffening parts usually are placed on the interior; otherwise, they should be on the exterior, where they may be inspected and where they will be free from corrosive influences. Since the number of holes through the sheets of a vessel should be kept a minimum, stiffening devices should be welded rather than riveted. Preference should be given to welded stiffener seams that act in shear or compression rather than in direct tension.

In Fig. 4 are shown several methods for stiffening flat surfaces to resist either pressure or vacuum. Of particular importance on vessels that are not protected by a roof is the arrangement of stiffeners so that rain water will not be prevented from draining away.

Interior corrosion of a steel vessel usually is not equally distributed; accordingly, some money may be saved by thickening only those parts subject to the most unfavorable conditions. For example, a steel sulphuric-acid absorbing tower, which usually fails by puncture of the bottom or by corrosion at the top flange, should have these parts increased in thickness, while the side

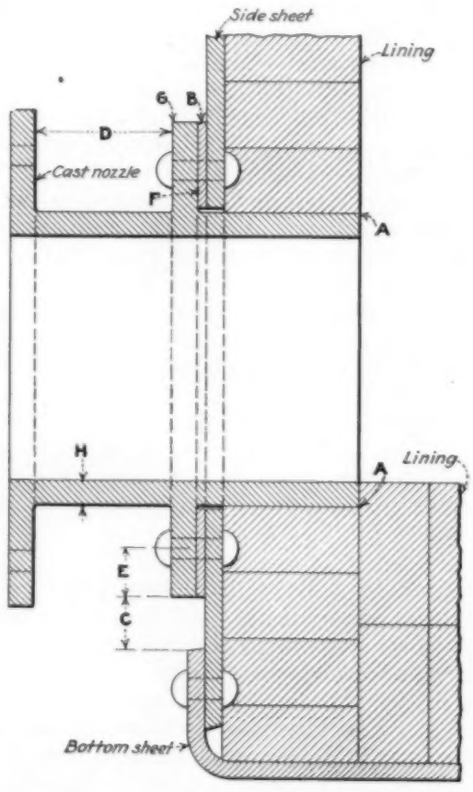


Fig. 3—Liquid Outlet
A—Should be rectangular to fit brickwork
B—Calking plate
C—Space should allow for calking bottom sheet and calking plate
D—Space should allow for riveting casting to side sheet and to make transition from circular to rectangular section
E—Sufficient to prevent casting from being broken when riveted
F—Surface of casting cast against core when possible
G—Casting should be ground flush with calking plate before riveting
H—Thickness of casting at bottom increased to give longer life.

sheets protected by the brick lining may be safely made ¼ or 5/16 in. thick. However, caution is necessary when designing brick-lined steel vessels which are to contain hot sulphuric anhydride, such as roasting furnaces, combustion chambers, or certain types of absorbing towers. If the outer shell is exposed to a cool atmosphere, then the iron sulphate which forms between the shell and the brick lining may burst the shell or crush the lining. Insulation of the shell usually is the proper remedy.

Corrosion often is conspicuous where a flow of acid is concentrated, as at liquid inlets and outlets, and it may be much cheaper and just as satisfactory to rivet

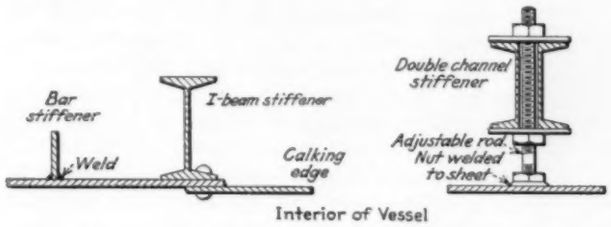


Fig. 4—Staying or Stiffening of Chemical Equipment

heavy plates at these points rather than to make the entire vessel of thick material. Parts subject to the abrasion of scrapers may also be provided with similar local reinforcement.

If a vessel requires a large number of threaded pipe connections its plates must be made sufficiently thick that three, or preferably five, threads may be obtained at the connection. If only a few connections are necessary, then it usually is cheaper to provide welded steel pads or forged steel flanges at such points rather than to use a thick plate. Where countersunk rivets are unavoidable, the plates should be slightly thicker than the height of the tapered portion of the rivet.

Lest the designer be tempted to economize too much, however, he should remember that an additional ⅛ in. of thickness on the shell of a steel vessel costs only about 25c. per square foot.

Rivet or Weld?

Principal operating features of riveted joints are these:

Advantages

1. Dependable and calculable strength.
2. Rigidity due to the added metal of the lap or butt strap.
3. Resistance to vibration, to impact, and to rapid temperature changes.
4. Parts are drawn tightly together.

Disadvantages

1. Difficulty of repair unless unit is shut down or partially dismantled.
2. Increased opportunity for leakage and corrosion through holes and rivet heads.
3. Calking of joints to insure tightness.
4. Compromises in design to accommodate riveting machinery.
5. Weakening of plates at holes.
6. Variations in heat transmissibility at lap or butt joints.

Principal features of fusion-welded joints are these:

Advantages

1. Full section of plates is maintained since no holes are necessary.
2. Low cost.
3. Speed with which repairs may be made.
4. Smooth surfaces for linings and insulation.

Disadvantages

1. Tendency toward brittleness, since the metal of the weld is cast in place.
2. Uncertainty of strength, unless welder is especially qualified.
3. Lack of uniformity in composition between weld and parent metal, resulting in variable corrosion resistance.
4. Unworkmanlike appearance of much welded work.

Combinations of the two methods usually are the most economical. As examples, a riveted lap joint may be calked on one or both edges by fusion welding, or a pressure vessel may be riveted together while its auxiliaries—supports, stairs, insulation shells—are welded.

Connections for Fluids

The design of connections for liquids is most important, since failure of steel vessels often occurs at such points. A cardinal principal in the construction of these connections is the avoidance of joints directly in the flow of the corrosive. This feature may often be realized by carrying the connecting pipe completely through the steel sheet, not merely "buttering" it on the outside. Usually the most satisfactory method is to use special cast-iron or steel nozzles. Fig. 3 shows a typical outlet for liquids.

In most cases the connections for gases correspond to those for liquids, with the exception that the nozzle is flared or "vestibuled," so that a gradual change in velocity is attained without undue "necking" for the gas flow. Often baffle plates can be advantageously placed either in the nozzle or just inside the vessel, to further aid in equalizing the distribution of the gas. Perforated baffle plates usually are more effective than solid plates. They should be positively anchored, since forces tending to displace them are often very considerable. If a steel pipe nozzle with a screwed flange is used, it is best to screw the pipe completely through the flange and then machine off the face of the flange flush with the end of the pipe.

Miscellaneous Openings

In addition to connections for liquids and gases, several other types of openings must be made in steel vessels. These comprise cleanouts, manholes, pyrometer pockets, sample holes, and gaging openings. In order to minimize the number of openings in a vessel, cleanouts

Fig. 5—Fabricating Wide-Flange Craneway Beams for Heavy Chemical Equipment

and manholes often can be combined with the liquid or gas connections. Cleanouts should be large enough to accommodate the cleaning tools, fire hose, and electric light, besides the maximum sized piece of débris that must be raked through them. The smallest manhole that should be allowed is 11x15 in., and 14x18 in. is much better. It should be made to use a standard gasket. If placed in a vertical shell the long axis always should be horizontal; and if in the top of a horizontal cylindrical tank, the long axis should be on a circumferential line. Manholes should not be set over seams. Since manholes usually must take a great deal of punishment, the experienced designer makes the machined contact surfaces between the ring and the cover at least 3 in. wide and the bolts sufficiently large and closely spaced that they do not require inordinate tightening.

Pyrometer pockets sometimes are made of standard pipe with one end welded shut and the other screwed into a pipe bushing which has been tapped clear through. Such a pocket soon starts to leak, or it may corrode in the vessel and be very difficult to extract. Better devices are a steel boiler feed pipe bushing or a flange bolted to a flanged nozzle which is riveted or welded to the shell.

Sample and gaging openings should be made flanged instead of threaded, since pipe threads soon become worn and cause leakage. Sample and gaging holes should be so arranged that any liquid removed through them does not drip onto the remainder of the apparatus. The deplorable appearance of many acid plants is due to acid spilled or dripped around the sampling or gaging stations; accordingly, the design of new apparatus should make such parts easy to use without spilling.

Since chemical plant operating and maintenance labor is expensive—usually not less than a cent per minute per man, and often a great deal more—the designer should not be niggardly in providing platforms, stairs, and ladders to make operations rapid, safe, and easy. For stairs—and only steel stairs should be considered—the designer should use the rule that twice the rise plus the tread equals 25 in., and keep as close to it as possible. A circular stair has only two advantages: it is cheap and occupies little space; but it is tiresome and dangerous to climb, especially if the plant operator is carrying anything. Where possible, stairs and platforms should be independent of the apparatus. Stair treads and platforms should be made of steel plates or grating of the non-slipping type.

An important auxiliary of chemical equipment is a trolley and a trolley beam for carrying packing, lining, and similar materials, and for lifting parts of the apparatus itself. For average loads, a trolley carried on a simple I-beam with its top flange stiffened by a channel is satisfactory. For heavy loads, double I-beams with four wheels running on tracks carried by the walls or building columns are advisable. Both types are moderate in cost and often will pay for themselves on a single shutdown, because they not only cut down the repair gang's time but also get the unit into production sooner.

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An American Impression of European Chemical Development

By F. J. CURTIS

Chemical Engineer
Merrimac Chemical Company,
Boston, Mass.

A NUMBER of observations regarding chemical development which the writer made during a recent European trip may very possibly be worth their setting forth in the pages of *Chem. & Met.* In several months spent in England and on the Continent I had the opportunity of examining certain major divisions of the chemical engineering field, including acetic acid and allied products, sulphuric acid, sugars from wood, nitrogen fixation, nitric acid and salt cake, cellulose acetate, and various miscellaneous research developments in Germany which probably are of future importance. Without attempting to carry this report beyond the strictly reportorial stage, I have set forth the principal observable facts concerning the present technical status in each of these fields.

Acetic Acid—During 1929 acetate of lime brought higher prices in the United States than in Europe, which increased the exportation of this commodity from European countries. At the same time, as in the case of the United States, there was a tendency for expansion in acetate rayon, increasing the demand. The result has been the development in England of one plant to make glacial acetic acid from imported carbide, and another, by a combination of English and German companies, from alcohol. This latter process oxidizes the alcohol catalytically to acetaldehyde, furnishing the same base material as is obtained in the carbide process from acetylene. It is planned to go to acetic acid, ethyl acetate, and acetone by direct catalytic methods, and through crotonaldehyde to butyl alcohol. There is, of course, an advantage in this method of producing butyl alcohol, in that no acetone is made. The universal opinion seems to be that the synthetic production of ethyl alcohol is quite possible technically, but not economically.

Acetic acid recovery methods, such as the Suida process (which extracts a mixture of acetic acid and steam in the vapor phase by means of wood tar oils), are increasing, especially in connection with acetate silk mills. A German company has a process worked out for converting acetic acid catalytically to anhydride, the two together giving flexibility to acetic acid recovery in acetate rayon plants, which use both glacial acetic acid and acetic anhydride. This procedure is superior to the

old sodium acetate recovery method, which furnishes anhydride alone.

Sulphuric Acid—During the last few years it has seemed that the United States is moving more and more in the direction of the contact plant, a movement which has been accelerated by the introduction of the vanadium catalysts. Europe, while not neglecting the contact processes, has also been developing the various chamber processes. A new Mills-Packard design has superior methods of supporting the lead and taking care of expansion and contraction. The angle of slope of chamber walls also has been decreased. The Gaillard type of plant has been showing an expansion on the Continent, although none has been installed as yet in England. Work is being done on the use of water cooling on the outside of the Gaillard tower in conjunction with acid spraying inside, especially in Australia.

A Petersen plant in Belgium has solved the problem of dealing with cold dilute SO_2 gases. In a way, the Glover and Gay-Lussac towers have been eliminated, although the functions of the towers necessarily go on. The plant has five towers all of the same height, but the last three are nearly three times the diameter of the first. Acid circulation is very complicated. Periodically the first small tower is cut out of the acid stream and the acid to be removed from the plant is here circulated until free of nitre. Dior chambers, which are conical in shape, use both inside acid spraying and outside water cooling. Chambers of this type have not increased in use, although such operation does show some advantage in high capacity at 2.3 cu.ft. per pound of sulphur per day. This is offset against a high nitre consumption of 5 per cent.

Backrack

MR. CURTIS reports these observations from a background of 15 years' experience in production, technology and chemical economics. After receiving his A.B. degree from Harvard in 1915, he joined the staff of the Merrimac company, serving as control chemist, research chemist, department superintendent, and more recently in engineering research and development

A new plant employing the Schmiedel process, which uses lead boxes containing rolls rapidly revolving in fairly concentrated nitrous vitriol to give a spray, is being created in Silesia. It is claimed to have 4 per cent nitre consumption and capacity of 2.13 cu.ft. per pound of sulphur. It is also claimed that the roller box may be substituted for the Glover tower when using cold gases.

More attention apparently is paid to cutting down dust production in pyrites burners than in the United States. The Bracq-Laurent furnace, which has a helicoidal hearth, avoids the dropping of the pyrites through the air. The Harris furnace has separated passages for pyrites and gas, so that the two do not come in contact with each other. A furnace of the Erzost Gesellschaft is equipped with special arms on the central shaft carrying chutes which conduct the pyrites from shelf to shelf. Cottrell precipitators are standard equipment for eliminating dust and fumes. A lively competition in vanadium catalysts is now in process between the Lurgi, I. G. Farbenindustrie, Monsanto, Selden, and Kuhlmann masses.

Sugars From Wood—This process as developed at Hamburg for treating wood waste by means of dilute sulphuric acid has become successful enough to be given an alcohol quota. Another process being carried out in the Rhineland uses muriatic acid for the hydrolysis, but so far only a small plant has been constructed.

Nitrogen—The outstanding development in the past two years has been the use of coke-oven gas, particularly in the Ruhr district, as a source of hydrogen. One company in France is successfully producing ethyl alcohol from the ethylene obtained in purifying coke-oven gas in a Claude ammonia plant. The great plant of Imperial Chemical Industries at Gillingham is being steadily pushed forward and new units are being brought into production. A Belgian company has developed the production of hydrogen from methane, thus utilizing all of the hydrogen in coke-oven gas.

Salt Cake—Shortage of this material has recently arisen, due to almost complete change in the method of manufacturing nitric acid. Where sodium nitrate was formerly used as the raw material, ammonia has now taken its place. Salt cake must be increasingly produced from salt and sulphuric acid rather than nitre cake. Waste from the German potash mines, which is the greatest source of natural sodium sulphate, is still only half utilized, and with the increase in prices, development may be expected in this quarter. One of the Italian companies is successfully producing glaubers salt in connection with pyrites cinder leaching operations.

Cellulose Acetate—The largest British company is increasing its production and another has a plant just started. A new plant is under construction in Belgium. In Germany the I. G. is a large factor in this field. Methods of recovery of acetic acid will play a very important part in the ultimate development in this industry.

Research—Interesting developments in research in Germany are in evidence in several of the research laboratories. At the Kaiser Wilhelms Institut für Kohlenforschung, at Mülheim, 90 per cent of the methane in coal gas has been converted to acetylene by passing it through an electric arc, thereby increasing the hydrogen percentage in the gas from 50 to 75. This acetylene has been converted by catalysis to paraffin oils and to acetic acid.

Benzol has been synthesized from water gas and is found to be equal in every way to the natural product. Bacteria have been developed which remove carbon monoxide from water gas and coal gas by reducing 98 per cent of the CO to methane and water. Molds flourishing on brown coal convert it to an organic form available as plant food. Experiments on brown coal show the possibilities of completely eliminating the ash, so that the dust can be used as a motor fuel. At the Kaiser Wilhelms Institut für Physikalische Chemie, under the direction of Haber, the basic principles of catalysis are being investigated as a step toward the intelligent discovery of new catalysts. Atomic hydrogen has been found under some circumstances to act as an oxidizing agent and to have two forms, ortho and para, the properties of which are being studied. Methods have been developed for determining the effect on the spectrum of different radicals in flames.

Modernized Silica Grinding Pays Big Dividends

By R. L. CAWOOD

President, Patterson Foundry & Machine Company
East Liverpool, Ohio

DURING the decade just past, we have witnessed what might well be called a second industrial revolution in the many new processes which have swept the country, and the new possibilities that have been discovered in machinery. With all this it is strange that the subject of economical grinding has received so little attention at the hands of engineers, either in the technical press or in books. Yet in spite of a lack of technical publication on the subject, much has been accomplished within the past ten years to lower grinding costs in the mining, metallurgical, and chemical fields, and rapid strides are now being made in the development of apparatus and in the reconstruction of grinding plants, as well as in the redesign and revamping of existing grinding departments in many factories.

One example of what has been done is to be found in silica grinding. While this material occurs both as quartz and sand, the present article deals with the latter form only. Large deposits of silica rock occur in many localities throughout the United States, but on account of their accessibility and because their locations are within easy shipping distance of manufacturing points, the deposits in the states of Pennsylvania, West Virginia, and Illinois are perhaps the best known. These undoubtedly supply the largest quantity of silica or glass sand to the markets throughout the United States.

Sandstone is crushed into sand, is washed and dried, and in that condition is shipped from the crushing plant located at the deposit. Where the sand is to be used in making glass, concrete, and for foundry-core and sand-blast sand, as well as for many other purposes, this crushing suffices. When it is to be used in the ceramic industry, however, an industry which is a very large user, much of it must be supplied in powdered or pulverized form. This pulverized sand, or "flint," as it is usually termed in the ceramic industry, constitutes about one-third of all the raw materials used in the manufacture of pottery, porcelain, tile, and other ceramic goods, and it usually is the lowest priced material used in the mixture from which the higher type products are made.

GRINDERS of silica or flint have experienced considerable difficulty in the past few years in grinding this material at a cost sufficiently low to meet market conditions and still make a profit. Consequently, the reconstruction of the grinding plant of The Potters Mining & Milling Company at East Liverpool, Ohio, which was accomplished during the past year, is most interesting, in that the cost of grinding has been cut almost in half, while at the same time the quality of product has been greatly improved.

Only a few years ago this class of material was ground to a fineness of 97 per cent through 140 mesh, but the demand for a finer product has gradually asserted itself until the standard specification in the ceramic industry today is 97 per cent through 200 mesh, thus making the grinding operation considerably more difficult and also increasing the cost of manufacture.

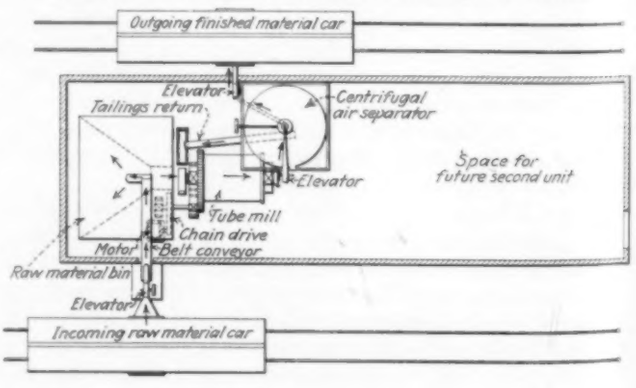
The Potters Mining & Milling Company is one of the oldest grinders of flint in the United States, having been in continuous production since 1885. The plant was increased in size from time to time until fully 30 batch mills, varying in size from 6x5 ft. to 7x8 ft., were in operation 24 hours per day and six days per week. Sand comes in from the crushing plants in Pennsylvania in box cars lined with paper to prevent leakage. This was formerly unloaded by hand into elevators, which carried it to storage bins, from which it was wheeled by hand and dumped into the mills. On account of the large number of mills in operation and because they were installed in a single long battery, several storage bins were required. As the mills were all of the batch type, after the grinding operation had been completed the doors were changed and the material discharged by sifting through a grated door as the mill revolved. Considerable dust arose during this discharge period as well as during manual handling operations. The mills were fitted with separate elevators and conveyors, line shafts, countershafts, and so on, and a number of bins were required for the storing of the finished material. To a very great extent the loading of the finished product into outgoing freight cars was carried on by hand.

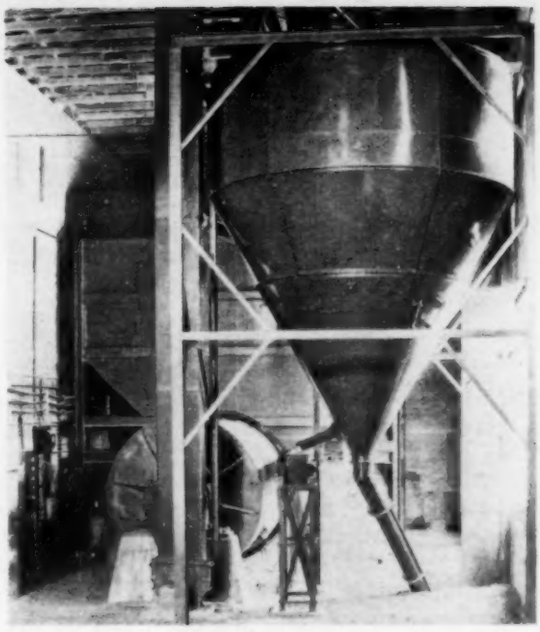
CONSIDERABLE POWER was wasted with the old installation, and machinery upkeep was most burdensome, due to the abrading action of the dust which was always present in the mill room. Breathing of the dust-laden atmosphere also constituted a health hazard for the workers, all in all producing a condition that was undesirable for many reasons.

A new grinding unit recently installed replaces approximately half of the batch type mills and replacement of the balance will be undertaken at an early date. This unit consists of a Patterson 8x10-ft. continuous feed-and-discharge ball mill, lined with silex, and operated in conjunction with a 14-ft. air separator. The mill is fed directly from a 100-ton storage bin, and the finished product discharges without intermediate storage directly into waiting freight cars. As it arrives, sand is unloaded directly from the incoming freight cars into an elevator which carries it to an overhead rubber-covered belt conveyor, fully inclosed to prevent escape of dust. This conveyor dumps into the 100-ton bin, where every precaution has been taken to prevent escape of dust. This bin is of steel, supported on structural steel framework, all of which was completely welded together on the job.

This bin has a sloping bottom fitted with a feeding device of variable capacity, driven by a ¼-hp. motor,

Less Than Half a 30x100-Ft. Building Is Required for Complete Grinding Installation as Shown by Plan Below





This View Emphasizes Compactness of Continuous Silica Grinding Plant of Potters Mining & Milling Company

which accurately controls the mill feed as desired. The device feeds the material into a pit from which the scoop feed on the mill picks it up and passes it through the hollow shaft or gudgeon into the mill. As fed to the mill, sand is approximately 93 per cent through 40 mesh.

It is recognized that the greatest part of the grinding takes place in the first few feet of the mill. Hence, dependence is placed upon the removal of the fines as fast as they are created. To this end, the mill is operated in closed circuit with an air separator. As the fines are produced they float to the top and are discharged through the shaft at the end opposite from the feed, a special seal being used at this point to prevent escape of the fines as the mill revolves.

AT THIS POINT a novel device is used to overcome a difficulty always experienced with continuous feed and discharge mills. All such mills should be filled to as near the center line as possible with the grinding media, but due to the large size of the openings in the shafts, trouble usually is experienced because the pebbles or balls are discharged along with the material, clogging and injuring the elevators and other equipment following the mill. They sometimes even find their way into the finished product. To avoid this difficulty, a circular screen has been attached to the gudgeon and revolves with it. Pulverized material sifts through the screen, but occasional pebbles discharged with it are carried over the end of the screen. The finished product enters one passage and is discharged into the elevator, while the stray pebbles enter another passage and are discharged into a bag, so that they may again be fed to the mill along with the silica.

Upon entering the elevator, ground material is elevated to the air separator, which is of the centrifugal type, 14 ft. in diameter and specially constructed for the handling of this abrasive material. It also is specially fitted to make it absolutely airtight. The separator receives the ground product, and automatically separates the fines and the oversize without the use of screens or sifters. Oversize returns by gravity and conveyor to the mill for regrinding. In accordance with usual close-circuit practice no attempt is made to grind all of the product to the ultimate fineness during the first pass through the mill. All fines are removed as fast as they are created, while only those which are sufficiently fine to pass the ultimate mesh requirement are discharged as finished product.

PROPERLY sized material discharges from the separator into an elevator which carries it high enough for gravity discharge to the waiting cars. No storage bins with attendant investment, maintenance, and operating costs are used. Silica is never touched by hand after the incoming cars are unloaded.

A building 30 ft. wide, 40 ft. high and 100 ft. long not only houses the entire unit but provides sufficient space for the contemplated second unit.

Standard specifications for the finished product were noted above as 97 per cent through 200 mesh. This company, however, makes a specialty of a product which is extremely fine, and a great deal of its business calls for material over 99 per cent of which must pass 200 mesh. In addition, it is possible by slight adjustments, which can be made within an hour's time, to grind a product varying from 100 mesh to 300 mesh, or finer.

Some interesting figures have been collected on costs at this plant. In the matter of horsepower, the elevator and conveyor which unload the cars are driven by a single 10-hp. motor, which by calibration is found to require 4 kw. for normal operation. As a 50-ton car can be unloaded in six hours, the power consumption for unloading is 0.48 kw.-hr. per ton of material handled.

The ball mill is driven by a 100-hp. motor requiring 80 kw. when output is running from 1.5 to 1.75 tons per hour, so that 53.5 kw.-hr. is required for the mill per ton of material ground. The feeder, elevator, air separator, finished product elevator, and tailings conveyor require 12 kw.-hr. per ton of material ground. With this type of installation it is possible to obtain favorable rates on a power tariff based on 80 per cent load factor, so that the rate becomes $0.0126 per kilowatt-hour. On this basis, the theoretical load factor is 85.2 per cent, allowing 5.2 per cent for periods when the load may be off the line during regularly scheduled operation. Hence with the load factor of 80 per cent, and basing the grinding on 99 per cent through 200 mesh, the total power cost for the operation of the entire plant is $0.83 per ton of material ground. When a product of 97 per cent through 200 mesh is ground, the power cost is $0.72 per ton. This compares with a former power cost of $1.75 per ton for grinding 97 per cent through 200 mesh and $1.95 for 99 per cent through 200 mesh.

In addition to power savings, there is much less equipment in operation, far fewer moving parts, and the cost of maintenance is estimated to be only about one-half of that required by the old equipment. Labor cost also is moderate, inasmuch as, on a basis of 40 tons per day, only two men working 8 hours are needed to unload the incoming cars of raw material. Three men working shifts of eight hours each operate the machinery, making a total labor requirement for a production of 40 tons per day of 40 man-hours, or about half that required for equal tonnage handled in batch mills. These tangible savings, coupled with improved working conditions through the complete elimination of dust, have amply proved the wisdom of modernizing grinding operations of this type.

READERS' VIEWS AND COMMENTS

An Open Forum

The editors invite discussion of articles and editorials or other topics of interest

The Properties of Creosote as Marine Preservative

Editor's Note: Included in the article by Robert E. Sadtler on the mission of the Chemical Warfare Service to industry, appearing in the February issue of *Chem. & Met.*, were some brief comments on preservatives for marine piling. Since these statements have provoked objections from several authorities, it has been considered preferable, in publishing their remarks, to append the hitherto unpublished section of Lieutenant Sadtler's paper. Originally omitted because of its great detail in what was intended as a general survey, it may now serve to explain some of the doubtful points raised and to show, further, the intent of the original statements.

To the Editor of Chem. & Met.:

Sir:—Your contributor, Lieut. Robert E. Sadtler, makes some very direct statements in his article in the February issue of *Chem. & Met.* The statements to which we refer are:

> Straight creosote usually used on waterfront structures will not stop the borers. About 15 chemical compounds are known at present which furnish from 25 to 50 times greater protection against marine borers than creosote. The protection offered by creosote alone may be increased very materially, at slight cost, by the addition of some of the poisonous compounds mentioned above. Fuel oil plus a specific poison will give better protection than is afforded by creosote at a lower initial cost.

The great efficacy, and, from the foregoing statements we presume, proved efficacy, of so many materials over creosote, is interesting. We would greatly appreciate the details which support these statements.

R. E. MEYERS,

In Charge, Dep't of Chem. & Tests,
International Creosoting & Construction Company,
Galveston, Texas.

To the Editor of Chem. & Met.:

Sir:—The writer's attention has been called to the article by Lieutenant Sadtler in your February issue and to the hitherto unpublished portions of his paper [printed below].

The writer has studied this problem for many years, was director of the Marine Piling Investigations of the National Research Council (1922-1924), and has since been a member of the wood preservation committee of the American Railway Engineering Association. Also in bulletin 321 of the latter association for November, 1929, the report of the marine piling sub-committee, on pages 688 to 702, contains a report showing practically no attack to date on creosoted piles with service of 39 and 28 years respectively and another report of a pier with 47 years' service. From his experience, then, and in the light of these recorded facts the writer absolutely disagrees with the statement in Lieutenant Sadtler's article regarding the efficiency of straight creosote.

There is a great danger in uninformed people drawing conclusions not justified by facts. All that Lieutenant Sadtler says, in the unpublished portions of his paper, is true; but the fact remains that, for economic or other reasons, many of these compounds are not suitable for wood preservation. It is also a fact that a few years' test does not indicate definitely the amount of protection which any given preservative gives. It takes a long time to demonstrate values. They realize this because of the fact that they plan for a 10-year test in some of their compounds and I have high hopes of their success.

Certain pieces, treated with compounds which were considered by the Chemical Warfare Service to be the most promising, are now under test and being reported on annually by the wood preservation committee, American Railway Engineering Association. These tests have been under way for about five years and there is so far no evidence that these preservatives are superior to creosote. In fact, there are indications that some of them are not so good, but the period of test is too short to justify drawing conclusions.

My principal objection to the paper, as you notice, is the statement it makes about creosote. The value or lack of value of creosote in given conditions is thoroughly demonstrated by tests running for 50 or 60 years, and the Chemical Warfare Service should not make statements of this kind, because creosote, so far, is the only known efficient preservative. Such statements would do no harm in the case of persons who were fully informed on the subject, but much work of this kind is done by people who are not fully informed, and with them statements of this kind would be very misleading.

WILLIAM G. ATWOOD,

Chairman Marine Piling Sub-Committee,
Committee XVII—Wood Preservation, A.R.E.A.

To the Editor of Chem. & Met.:

Sir:—My attention has just been called to the article in your February issue, entitled "Chemical Warfare Service Saves Millions for Industries," by Robert E. Sadtler, and especially to the author's statements on creosote for waterfront structures.

Having followed the developments of marine piling protection for a great many years (I was a member of the National Research Council Committee referred to by the author), I am somewhat surprised at the very positive statements made. I know of no evidence to substantiate this statement: "Straight creosote will not stop borers." It is true that straight creosote treatment will probably not stop the borer *Martesia*, but this, after all, is one of the least important of the borers so far as piling is concerned. Straight creosote treatment, on the other hand, has stopped the activity of borers for a great many years, not only in this country but in other countries. We have just removed some creosoted piling in

the Norfolk district, at a point where one of the railroads terminates, which has been in service for 43 years and 49 years. These piles were removed for the purpose of examination, and are still in perfect condition. Numerous reports are also available in the proceedings of the A.R.E.A. and the report of the National Research Council Committee, published by Atwood and Johnson. When piles are treated with sufficient quantities of the right kind of creosote and when treatment is efficiently conducted, there is no question but that creosote still offers the best protection that we know of.

The investigations of the Chemical Warfare Service are to be approved in every respect; they offer valuable suggestions. But the service records of the addition of toxics to fuel oil are of such very recent date that sweeping statements made about it are in no way warranted. It will be a great many years before we can even begin to make such a comparison as is made in this article. The undersigned would incidentally mildly protest against the publication of such specific statements which are liable to be misinterpreted by the uninformed.

HERMANN VON SCHRENK,
Consulting Timber Engineer,
New York Central Lines,
St. Louis, Mo.

Unpublished Sections of Lieut. Sadtler's Article

The poisonous compounds to be experimented with were made and investigated at Edgewood Arsenal, Maryland. More than 100 compounds in all were studied. It was found that the organic compounds of mercury, arsenic, and copper were the most effective poisons against the various types of borers. It is interesting to note that most effective of all were the arsenal compounds, used in chemical warfare, or derivatives of those compounds. Lewisite, the most poisonous of the war gases (made by passing acetylene through arsenic trichloride in the presence of aluminum trichloride as a catalyst), gave a derivative which proved to have the highest specific toxicity against marine borers.

The poisonous compounds were mixed with either fuel oil or creosote, and in this mixture were saturated test pieces of pine and oak, 1 ft. long and 3 in. square. Each compound was soaked into three tests pieces, and they were installed in sets of three. Each of the test pieces was sheathed on two sides by untreated half-inch pine boards. The embryo marine borer was thus enabled to gain entrance in the untreated wood and by the time the chemically treated portion was reached the ship worm was fully grown and less susceptible to the action of the poison. In three months the untreated pieces were completely riddled by the borer. The test pieces which completely stopped the borer, however, were the ones soaked in the solution of creosote of five compounds: Mercury benzoate, copper, ortho-nitrobenzoate, mercury resinate, mercury stearate, and diphenylaminechlorarsine (the poison smoke material).

The most effective of the above mixtures having been determined, they were used to treat pine fence posts about 8 ft. long, and 6 in. in diameter. Thirteen sets of 10 posts each were installed in the Beaufort Harbor, in 1924, and one post of each set will be removed each year for inspection, and by removal in this manner the test will cover a 10-year period.

[It was found that straight creosote, usually used on waterfront structures, will not stop the borers. About 15 chemical compounds are known at present, which furnish from 25 to 50 times greater protection against marine borers than creosote. The protection offered by creosote alone may be increased very materially, at slight cost, by the addition of some one of the poisonous compounds mentioned above. Fuel oil plus a specific poison will give better protection than is afforded by creosote at a lower initial cost.]

The use of these poisons will not involve any change in the present commercial methods of treating piling, and there is little or no increased hazard in the installation of this.

Heat Calculation for Flash Distillation

To the Editor of Chem. & Met.:

Sir:—The article by Smith D. Turner and J. W. Harrell entitled "Calculating Heat for Flashing Petroleum Hydrocarbons," in *Chem. & Met.* for February, offers a constructive method for the solution of this important problem in design. However, I wish to call attention to simplifying assumption No. 4 in the article, which reads that "The average heat of vaporization is that corresponding to the molecular weight of the fraction, x_1 vaporized."

In a critical review of existing data on the thermal properties of petroleum, the latest, most complete assembly of such information at the present time, compiled by the Bureau of Standards (issued as Miscellaneous Publication No. 97), the danger of predicting latent heats of vaporization from apparent molecular weights and the use of Trouton's or Hildebrand's rules was brought out. Such values invariably are higher by as much as 100 per cent compared to actual measurement. The reasons advanced are that (1) Trouton's and Hildebrand's rules are not applicable to complete vaporization of mixtures with a wide range of boiling points, (2) the "apparent" molecular weights of such distillates are too low.

From careful correlation of data the following equation is recommended:

$$L = 1/d\ (110.9 - 0.09t)$$

in which L is the latent heat of vaporization in B.t.u./lb.; d, the specific gravity of the liquid vaporized at 60 deg./60 deg. F., and t, the temperature in deg. F.

Consequently it would seem logical that instead of assumption No. 4 the following be substituted:

> 4. The average heat of vaporization is that corresponding to the average gravity and temperature of the vapor formed in the process.

This is in conformity, then, with assumption Nos. 1, 2, and 3.

If this precept be followed in the example given for 27.3 deg. A.P.I. crude, the latent heat of vaporization = $(1/0.7796)(110.9 - 0.09 \times 480) = 86.8$ B.t.u./lb.

Substituting this value for L in the equation of Turner and Harrell,

$$Q = (86.8 + 818 \times 0.656)(0.562) - (0.5 \times 818 \times 0.656 - 0.564)(0.562)^2 = 338.1 \text{ B.t.u./lb.}$$

Following the suggestion of the authors that for most engineering purposes the properties of the crude may be assumed at the temperatures involved without loss of appreciable accuracy, the latent heat in this case, calculated as in the preceding, becomes 75.9 and hence

$$Q = (75.9 + 818 \times 0.658)(0.562) - (0.5 \times 818)(0.685 - 0.554)(0.652)^2 = 340.3 \text{ B.t.u./lb.}$$

The total heat is 340.3 + 76 = 416.3 B.t.u./lb., a reasonable check.

The gravity at the mid-point of vaporization of the fraction was used as an approximation to the average gravity of the fraction, the rate of change of gravity with vaporization being unknown. Use of the gravity of the entire fraction lowers the latent heat value by almost six B.t.u. The use of the average gravity approximation is justified apparently by the close check obtained when the properties of the crude are substituted for those of the respective fractions following the authors' suggestion. Use of the gravity of the whole portion vaporized would increase the discrepancy between the two methods.

It is believed that the method advanced by Turner and Harrell is too valuable not to take advantage of all possible accuracy, and criticism is offered in this light only.

GEORGE H. FANCHER.
Department of Petroleum Engineering,
Colorado School of Mines,
Golden, Colo.

To the Editor of Chem. & Met.:

Sir:—Professor Fancher suggests that in our method of calculating the heat required for flash vaporization, the latent heat be based on the gravity and temperature of vaporization rather than on the molecular weight of the fraction vaporized. Certainly, in applying this method, the most reliable data available should be used. Our essential point in assumption No. 4 was that a heat of vaporization corresponding to the fraction vaporized, and not to the original oil, be taken. If this can be obtained more accurately, or with greater confidence from a correlation involving specific gravity and temperature, one should use it in preference to Hildebrand's rule.

SMITH D. TURNER.
Humble Oil & Refinery Company,
Baytown, Texas.

Interplant Movement of Dangerous Materials

Editor's Note: In an article entitled "Interplant Movement of Materials," by Bronson L. Huestis, Supervisor Accident Department, the Bureau of Explosives, on page 254 of *Chem. & Met.* for April, are included certain items which, as printed, are not wholly in accordance with what was intended. It is urged that readers of the original article be guided by the following comment which the author has made in order to prevent misunderstanding.

To the Editor of Chem. & Met.:

Sir:—While it is apparently the practice of your magazine to use the word "flammable" when speaking of certain materials that take fire easily, the regulations of the Interstate Commerce Commission for the Safe Transportation of Explosives and Other Dangerous Articles, when referring to combustible liquids which give off ignitible vapors at or below 80 deg. F. or to certain dangerous solids, designate them with the word "inflammable." Hence, it was the latter which the writer originally used wherever the word "flammable" is printed in the article, and which must be employed when the Interstate Commerce Commission's regulations are concerned or quoted, as these regulations have the force of law, and the exact nomenclature of that law must be used.

Toward the bottom of the first column on page 255, the comma after the word "nitroglycerin" makes it appear as if nitroglycerin could be shipped in a box, whereas earlier on the same page it is made plain that straight nitroglycerin must not be shipped at all by freight or express. The article was intended to read "Nitroglycerin Dynamite," this being the form of dynamite which may be subject to exudation of liquid. In the same sentence between the words "liquid" and "ingredient," the word "explosive" should be inserted.

On the same page, toward the end of the second column, the unintelligible phrase "while black powder underlies various alternatives" evidently represents a condensation of the original and, due to an unfortunate transposition of words, leaves the meaning obscure. The container alternatives for black powder are I.C.C. No. 13 metal kegs, I.C.C. No. 10 wooden barrels or kegs, or I.C.C. No. 14 and No. 16 wooden boxes. Where the boxes are used, the powder is packed in interior containers consisting of fiber, or metal containers, or cloth bags. When black powder has been compressed into pellets (cylindrical blocks) $\frac{7}{8}$ in. or more in diameter, they may be packed in strong paraffined paper cartridges not more than 12 in. long, inclosed in I.C.C. No. 14 or No. 16 wooden boxes, gross weight 75 lb. maximum. In net aggregate weight of 100 lb. or less, black powder, packed in metal containers firmly tied together with rope, may be shipped in a wrapping of strong burlap, canvas or similar material, securely sewed and roped about the containers.

The photograph on page 256, captioned "Kegs of Black Powder Properly Packed in Box Cars for Shipment," represents a method no longer in use. Accordingly the accompanying picture is given to show the present authentic method of full-carload loading. One of the main

features of this loading is the taking up of all slack at the center of the load by a double plank gate, the two parts of the latter being wedged apart by a group of vertical pieces shown. The portion of the load in the immediate foreground, of course, has been removed to show better the arrangement of the kegs, and as indicated, both doors of the car are to be boarded up to the height of the load.

On page 257 of the article, third column, third paragraph, in the sentence beginning "Carboy boxes," the words "and the month and year when the package was last cushioned" should be omitted, as a revision of the I.C.C. regulations has removed that particular requirement.

In an article based to a large degree on the requirements of law, the importance of accuracy is especially significant, hence these comments are presented with the renewed request that readers note them carefully.

BRONSON L. HUESTIS.
Supervisor Accident Department,
Bureau of Explosives,
New York City.

Permanent Prosperity Versus Chemical Merchandising

To the Editor of Chem. & Met.:

Sir:—The best minds of the country in business and government are being focused on "permanent prosperity," to see what makes it tick and how it can be made to stay with us for a while.

Prosperity comes from buying power, which comes from full employment, which depends upon operations at a profit. Given this latter for a period and the others automatically follow. But "operations at a profit" is dependent upon the co-operative attitude in business wherein the chemical industry in its merchandising policies and secretive aloofness is not on a plane with the most progressive industries of the country.

We have been brought up to accept the platitude "competition is the life of trade" as being true under all conditions. Today we know that unrestricted competition is a very destructive force in the prosperous life of business. This is so fundamental that it must eventually be recognized by both business and government when the spotlight has been turned with full power upon "permanent prosperity."

Arthur Brisbane strikes the chord when commenting on the gasoline war in California. He says "Here the price has been cut as low as ten cents and deeper cuts are expected. This is due to disorganized production and disorganized distribution. Any buyer who exults in the low price of today exults prematurely. He will more than make up for it later on." He implies that this condition is wholly destructive to both buyer and seller and contains no constructive elements which will endure. The sale of goods below cost of production comes out of somebody's hide in the final analysis.

When several concerns start a death grapple for supremacy and reduce prices below the cost of manufacture, prosperity always suffers. Those forced to the wall must throw their employees out of work. The buying power of their community is reduced. The creditors receive ten cents on the dollar and must curtail expenses. The survivor increases his share of the area's business from 30 to 70 per cent, but when he raises the price level to recoup his losses he attracts twice the number of competitors he formerly had. These smaller competitors can always be financed for a limited time, and sell below cost to get established or to fail.

The dominant manufacturer is then faced with a reduction on his 70 per cent of the area's business to hold his trade. He is more vulnerable than formerly, and his dream of empire is shattered. The buyers of his products again buy cheaper, but face a declining demand for their goods and, eventually, when sanity is restored, will pay a price which permits a reasonable profit for the surviving producers.

The chemical industry should get together along modern, legal lines of co-operative effort. Your competitor is a good man to know and understand, because he sets the price at which you must sell your product. Intelligent vision by the leaders in the chemical industry could help business prosperity by guiding their affairs along sound lines of economic and human relationship. The great secrecy now surrounding the industry has been thrown overboard by the progressives in other lines, such as the automobile companies.

The purpose of all business is to show an annual profit. Otherwise, it cannot long serve the public by its products, its employment of labor, or its contribution to prosperity. To secure an annual profit it is necessary to know costs, competition, and economic conditions. These factors, being standardized and reported, a price level permitting an adequate profit would automatically be reached, without "price fixing" or agreements among competitors. Trade ethics of a higher standard would be called into practice.

It has been suggested that industry in its search for more stabilized prosperity must throw more work upon its trade associations. It must co-operate more fully in furnishing data to bring about a wider knowledge of conditions. It must call on the government to permit closer contacts and exchange of information among the members of an association. It could ask the government to form and supervise a National Trade Association Board, composed of leaders in business, industry, finance, and government operation, whose membership would consist of the 900 trade associations of the United States, and whose functions would be advisory and regulative where unfair trade conditions exist. It would be aimed at "permanent prosperity" and would go far to check declining prices and overexpansion of capacities.

The American Institute of Food Distribution has been thinking along these lines and makes some excellent abstract suggestions:

"The control should come from human intelligence properly applied, rather than by arbitrary agreements.

"To determine the way to get this all-saving intelligence into each group, we must first realize that the greatest single menace in the present intimate competition is unintelligent management—blind egotism, lack of knowledge of costs, market conditions and economic laws; and especially the survival of the old belief that an individual can pull fast moves that will take advantage of his competitors.

"To have sound competition relationship, we must recognize that any move by an outstanding factor is normally followed, almost immediately, by all of the factors in competition. This applies alike to special prices, deals, and clever tricks to gain advantages.

"Any member of a trade association would hesitate to do an unintelligent thing if he knew that all of the other members were aware that he had not taken sound action, and if he knew that such a move would be immediately reported to all of the others.

"Why not recognize the ultimate interest of all in having intelligent management in each business group? Why not recognize that the one thing that would do most to give stability to each business individually would be the gathering and distributing of so full a record of facts that each man in the trade had the opportunity to know exactly what he was doing? To know the truth about his competitors and to realize that his acts will be reported to them and will be generally followed by competitors?

"This is a broad field where a great measure of work must be done to secure efficiency, but it is a field where every business association should be properly encouraged by the government. Most of the controlling statistics should be assembled by an official body, leaving the interpretation and the details of exchange of daily moves to each trade group."

Business wants as little government control as possible. But it has an obligation to its investors, to labor, and to prosperity which it cannot fulfill. It needs help and its management very often needs a full-length looking glass.

Economist,
New York.

ALBERT H. DOOLITTLE.

CHEMICAL ENGINEER'S BOOKSHELF

The Chemical Engineering of Oil

AMERICAN PETROLEUM REFINING. Second Edition. By *H. S. Bell.* D. Van Nostrand Company, Inc., New York, 1930. 631 pages. Price, $6.

Reviewed by D. B. KEYES.

NO BOOK on petroleum refining written in the English language is better than Mr. Bell's, at least from the engineer's standpoint. It is interesting to find that a large share of the so-called engineering problems included, especially the mathematical deductions, formulas, and equations, are what is commonly known today as the principles of chemical engineering. In other words, petroleum refining has become one of the great, if not the greatest, chemical engineering fields in the world.

The book starts with three chapters on the characteristics, both chemical and physical, of the crude oil and its various products. The chemical properties of the petroleum constituents are treated in a manner that even a mechanical engineer with no chemical training would be bound to understand.

The chapter on manufacturing processes gives a splendid outline of the entire refinery. It is written clearly, concisely, and in an interesting manner. One chapter on choosing the refinery site is of considerable practical value and at the same time is very entertaining.

The discussions on distillation, shell stills, pipe heaters, condensers, fractionation, and distillation units probably are the outstanding chapters in the book. The engineer who loves to play with empirical equations and make all sorts of estimates, of more or less value, will be delighted to find the more worth-while of these fundamental empirical equations in them. The modern viewpoint of chemical engineering and petroleum refining is given on many occasions; for example, the advantage of radiant heat in the pipe heater. The very doubtful value of recirculation of flue gases and the difficulty of fractional condensation in comparison to the ease of fractional distillation are nicely shown. Of course, the reader will not agree entirely with the author, especially in his distillation hook-ups, but the basic ideas are clearly stated and an author, after all, certainly is entitled to a few opinions of his own.

Three chapters on cracking describe all of the more important modern cracking units. It is interesting to note that the author has shown the fallacy of paying too much attention to reported yields of cracking units. As yields and capacity must be considered together, it is a very important point from an economic standpoint.

Very thorough chapters deal with chemical treatment, wax plants, filtration, and the like. It is quite evident that the petroleum refineries need more efficient filters, and it seems to be a problem that is not insurmountable. The chapters on compounding, packages, storage of oil, volume measurement, pumping of oil, and bulk transportation are very interesting and give a good picture of actual conditions. The book closes with several chapters on power plant, acid recovery, fire protection, evaporation losses, and, in order that nothing may be overlooked, a chapter on general departments, which covers such items as laboratories, shops, and pump houses.

It should be remembered that this is not a profound treatise on the subject, but is a book specially designed to give a good, clear view of the salient features and fundamental principles involved, especially from the engineer's standpoint, of a modern American petroleum refinery. Anyone who desires such a textbook will find Mr. Bell's new edition to be satisfactory in every respect.

Physical Chemistry by Practice

EXPERIMENTAL PHYSICAL CHEMISTRY. By *Farrington Daniels, J. Howard Mathews,* and *John Warren Williams.* McGraw-Hill Book Company, New York, 1929. 475 pages. Price, $3.50.

Reviewed by R. M. BURNS.

THIS is the most comprehensive text on the experimental side of physical chemistry that has appeared. The book is divided into three sections; the first being devoted to laboratory experiments, the second to apparatus, and the third to such miscellaneous operations as the calibration of weights and measures, the use of thermometers, glass blowing, and the purification of materials. Among the 78 laboratory experiments which are given, several are based upon recent researches in the literature. The presentation of each exercise contains a discussion of the theory, a description of the apparatus and procedure, method of calculation, practical application, suggestions for further work, and references to the literature.

The authors' method is pedagogically sound; the student is not asked to perform an experiment for the purpose of verifying a principle of physical chemistry, but rather he is presented with a problem with the necessary tools for its solution and encouraged to carry on an investigation. The subject matter of the book, on the whole, is well presented. Thermodynamic methods receive less attention than might be desired, and the theoretical treatment of electrode phenomena is not entirely satisfactory. The position of the reference electrode in polarization measurements should not be *behind* the polarized electrode, as stated on page 407, but should be *in front of* it. The authors doubtless are aware of the mis-statement on page 157, with respect to the convention of the sign of the electrode used in the International Critical Tables.

Sulphuric Acid Practice

SULPHURIC ACID AND ITS MANUFACTURE. By *H. A. Auden*, Longmans, Green and Company, London, 1930. 231 pages. Price $5.40.

Reviewed by J. H. PERRY

ADMIRABLY adapted for a student in college or for the plant man who desires to become rather intimately acquainted with the present state of sulphuric acid production, this book is written, as is natural, with practice in England foremost. The references to American practice are not always accurate but this is not detrimental to a general picture of the American industry. With a very little co-operation with an American sulphuric-acid expert, the author could have presented a book that would have had as wide an appeal here as in England. However, it is the most readable of any bearing on this subject that has appeared for a number of years. It does not contain the detailed references and information that "Miles" of the Lunge-Cumming series offers, but this is excusable, because the latter is more of a treatise whereas the present volume is a textbook and a book for more casual reading. So far as English practice is concerned the author has accomplished his purpose very well.

The book is divided into sixteen chapters, a section devoted to Tables, and the usual name and subject indexes. The order of the chapters is not as logical perhaps as it might be and "Sulphuric Acid From Sulphates" is certainly of minor importance. It is also believed that more space should have been devoted to the contact process. In future editions of this book, particularly if American practice is included therein, descriptions of the Mantius and Chemical Construction Company's concentration units should be included.

It is disappointing that the author should have preferred the old data on sulphuric acid (that of Knietsch) to those which are available in the International Critical Tables. On page 35, it is stated "According to Messel, the spent oxide from gas works, although practically free from arsenic is not suitable for use in the contact process." At least one plant in the United States uses such a source of sulphur for its contact process and the reviewer is under the impression that a number of Continental plants use sulphur from such sources in their contact plants; e.g., at Leunawerke.

A Foreign Appraisal of Cracking

DIE KRACKVERFAHREN UNTER ANWENDUNG VON DRUCK. By *Erwin Sedlaczek*. Julius Springer, Berlin, 1929. 402 pages. Price, 45 M.

Reviewed by JOHN V. JIRASEK.

TWO general sections comprise this book. The first is devoted entirely to the theory and classification of the various cracking processes, and covers more or less in detail the patents of Burton, Dubbs, Greenstreet, Hall, Rittmann, McAfee, Flemming, Cross, Jenkins, Isom, Ramage, Ellis, Coast, and so on. The author discusses at first in a general way the grouping of the processes into the two classes of vapor- and liquid-phase cracking, and then proceeds with the enumeration and description of the individual patents.

The second part of the book deals with the general design and operation of the various parts of cracking-plant installations such as heating apparatus, cylindrical retorts, pipe stills, metallic and salt baths, condensers and coolers, fractionating towers, and other equipment applied to cracking plants. Brief discussion is devoted to cracking by the application of electric current and various catalysts, especially aluminum chloride.

In its present form the book may prove valuable to a German-speaking student of cracking, and may be extremely useful to the German legal profession in tracing out the complicated maze of the different American and foreign patents in which the cracking industry is enmeshed. In the writer's opinion the book is of little value to the American petroleum industry in general, as it is not as complete as some of the books published during the past few years in the United States.

Colloid Publications

THE CHEMISTRY OF THE COLLOID STATE. By *John C. Ware*. John Wiley & Sons, Inc., New York. 1930. 313 pages. Price, $4.50.

THIS is "A Textbook for an Introductory Course," which undertakes "to present the fundamentals of colloid chemistry as they are disclosed by an analysis of the material available at this time and not in accordance with the facts of twenty years ago, when the subject was on the threshold of a period of very intensive scientific research." Although intended primarily for college student use, it gives a simple and rather readable discussion in language that will not occasion difficulty for industrial chemists and chemical engineers. It is the type of book that will facilitate gaining acquaintance with this important new branch of chemistry by those whose college days lay well before the recognition of the importance of this division of science.

COLLOID SYMPOSIUM ANNUAL, VOL. VII. Edited by *Henry Boyer Weiser*. John Wiley & Sons, New York, 1930. 300 pages. Price, $3.75.

THIS is the customary résumé in book form of tne papers presented at the Seventh Symposium on Colloid Chemistry, which was held in June, 1929, at Johns Hopkins University. The group of papers so assembled form one of the finest reference groups descriptive of the recent investigations and theoretical discussion on important phases of colloid phenomena. Because of the care exercised by the National Research Council colloid committee, which supervises the symposium, in the selection of speakers and papers, the group represents an exceptionally fine composite. All libraries which undertake to keep in touch with colloid literature at all should have the work.

George Fisher Baker Lectures

SOME APPLICATIONS OF ORGANIC CHEMISTRY TO BIOLOGY AND MEDICINE. By *George Barger*. McGraw-Hill Book Company, New York City, 1930. 182 pages. Price, $2.50.

THE Department of Chemistry at Cornell University should be congratulated on the lecturers it has had from foreign countries. Prof. George Barger, of Edinburgh University, has given an unusually interesting series of lectures under the title above. The relation between physiological action and chemical constitution is more important from a human health standpoint than any other subject in chemistry.

SELECTIONS FROM RECENT LITERATURE

COUCH PRESSES. K. Bernsau. *Wochenblatt für Papierfabrikation*, April 12; pp. 471-4. There are several advantages in having the upper roll of couch presses of large diameter. The life of the felts is prolonged; spoilage of paper is lessened; strength and appearance of the paper are improved; screen tension may be lessened, so that power consumption is decreased and screen life is prolonged. It is necessary, however, that the upper roll shall fit snugly in the screen, so that the pre-couching effect shall be adequate. This effect depends on the roll, and should be greater for thick than for thin paper. Some papermakers maintain that the roll setting should be constant, no matter what kind of paper is passing the rolls; but this view is erroneous. Proper operation of the couch rolls is discussed in considerable detail, while some common defects in the paper are mentioned and remedies offered.

ADSORPTION. L. Piatti and O. Spreckelsen. *Zeitschrift für angewandte Chemie*, April 12; pp. 308-10. In the use of active carbon for adsorption, difficulty is encountered in recovery of the adsorbed material if it is a relatively high-boiling substance. Steaming is a common expedient; but there has been a lack of quantitative data on the effectiveness of steaming and other methods of separating active carbon from adsorbed material. Experiments therefore were made with commercial cresol, to ascertain the actual amount of cresol removed per 100 g. of superheated steam (200 deg. C.) from a heavily charged carbon. For these tests, the carbon was charged with 144 per cent of its weight of cresol, and steamed with 600 g. of superheated steam per 100 g. of active carbon. The sample still retained more than 80 per cent of its weight of cresol. Application of dry heat expelled only about one-fourth of this residue. Since neither steam nor dry heat suffice for complete recovery of cresol, an extraction method was tried. It was found that a sufficiently prolonged extraction with a suitable solvent quantitatively removed the cresol from the carbon. Since very long steaming is necessary to remove any considerable proportion of the cresol, solvent extraction is the only commercially feasible method of separation. These results are considered to be applicable to other high-boiling liquids also, as well as to cresol.

CARBUROL CRACKING PROCESS. Karl Bender. *Chemische Apparatur*, April 10; pp. 76-7. The Carburol process for continuous cracking of heavy oils without coke formation is one of those methods in which the physico-chemical principles of pyrolysis are applied, with the purpose of providing optimum conditions for the formation of the valuable gasoline hydrocarbons. Recognition is given to the aid of pressure as a means of effecting the reaction at lower temperatures, and to the necessity of removing the reaction products promptly from the reaction zone. At the same time, the time factor is recognized, in that reaction conditions are maintained for a longer period than in other processes, to correspond with the lower temperature. The oil is heated to the desired temperature in pipe coils of small diameter, and is kept moving at a rate which prevents local overheating. At the end of the predetermined time interval, which is called the stabilization period, the pressure is suddenly released, and the oil, in a state of violent evaporation, is quickly cooled by contact with fresh oil. Immediate cessation of reaction conditions is thus attained. Coke formation in this process is so slight that a 5-ton installation has been in successful operation for two years, cracking a wide variety of crudes, without any coking except in cases of accidental interruptions in the continuity of the operation. The apparatus is so designed as to provide heat exchange between cracked products and incoming oil; heat economy is thus added to other savings effected by the process.

HOT AIR DRYING. Odön Vajda. *Chemische Fabrik*, April 16; pp. 141-2. The mixed air type of dryer, in which part of the effluent air is mixed with the incoming hot air, does not have any cost advantage in direct-current drying unless operating conditions are such that the maximum permissible effluent air temperature cannot be attained in a simple direct current dryer. In counter-current dryers, on the other hand, there is an intimate relation between the highest temperature to which the goods or material may be heated and the savings effected by returning part of the effluent air to the incoming air stream. This is because the temperature of the incoming air is strictly limited (not to exceed the highest safe temperature for the material being dried), whereas the temperature of the effluent air may be raised by any suitable means, so long as the same limit is not exceeded. One means of increasing the outlet temperature without raising the inlet temperature is to return a portion of the saturated effluent air to the dry incoming stream, so that the heat content but not the temperature of the incoming air is increased. This, within the temperature range of practical drying, lessens the heat consumption of the operation. Even where the cost advantage is relatively unimportant, the method may be used to advantage as a means of controlling the rate of drying. Curve charts are given, showing heat consumption of counter current dryers.

HIGH-PRESSURE VESSELS. *Industrial Chemist*, April; pp. 150-3. The trend toward higher pressures in chemical manufactures, in oil cracking and in boiler practice has brought noteworthy advances in the fabrication of high-pressure vessels. For the highest pressures one-piece heavy forgings occupy the field almost alone; welds are avoided, on account of the very grave consequences of even partial failure of a weld under operating pressures. For medium pressures, satisfactory results have been obtained with one-piece bodies having dished ends shrunk and riveted in. Synthetic ammonia accounts for a part part of the very high pressure equipment, but hydrogenation of coal or its distillates may be expected to increase the use of vessels such as are now used for making ammonia. These are mostly in the form of very large tubes made of high-tensile, heat-resisting alloys. High-pressure vessels used in dye manufacture are often of intricate shape, and must be made of highly corrosion-resisting metal. Vessels for oil cracking are generally one-piece tubes, in lengths up to about 40 ft., diameters 40 to 50 in., and wall thickness 4 to 4½ in. They are swaged down at the ends to form flanges for bolting on the covers. Those which are intended for vertical operation have solid forged collars to support them on their mountings. The current trend in boiler practice, both for land and marine boilers, is toward larger units and higher pressures (up to about 1,500 lb. per square inch in land boilers and 500 lb. per square inch in marine boilers). A description is given of the manufacture of forged ingot drums for this use, and photographs are shown to illustrate the manufacture of forgings for high-pressure vessels.

WELDING VARIOUS METALS. J. R. Booer. *Chemical Age*, Jan. 18, 1930; pp. 47-8. Welding behavior of metals is discussed, with reference to applications of welding to fabrication of chemical plant and other uses in the chemical industry. Aluminum and some of its alloys can be welded by the oxyacetylene method, but duralumin gives unsatisfactory welds. Most commercial copper will not weld properly, so copper should always be tested for weldability. Brasses can be welded by all processes, but with oxyacetylene a special procedure is necessary and the flame must be distinctly oxidizing. Phosphor bronze gives good results with a rod of proper composition. Chromium steels present several difficulties, but can be welded quite successfully if the carbon content is not too high. On account of the importance in chemical engineering of the corrosion resistance of chromium steels, the welding rod must be very carefully

chosen so that the weld will have equal corrosion resistance with the rest of the metal. Most cast iron can be welded, with proper precautions, by the oxyacetylene method; but the high-silicon acid resisting cast irons are difficult or impossible to weld successfully. For mild steels, arc welding with high grade welding rods is preferred. No method is successful with high carbon steels. Monel metal can be welded, without impairing its corrosion resistance, if proper procedure is followed and good penetration is obtained. The difficulty of welding nickel has lately been overcome by use of a special flux to prevent formation of the insoluble nickel-sulphur eutectic. Oxyacetylene welding is unsuitable for vessels to contain caustic soda; arc welding, or better still coal gas welding, is satisfactory.

Recent Government Publications

Documents are available, at prices indicated, from Superintendent of Documents, Government Printing Office, Washington, D. C. Send cash or money order; stamps and personal checks not accepted. When no price is indicated, pamphlet is free and should be ordered from bureau responsible for its issue.

Tests of Various Aliphatic Compounds as Fumigants, by R. C. Roark and R. T. Cotton. U. S. Department of Agriculture Technical Bulletin 162; 10 cents.

Specific Gravity and Baumé Gravity Tables for Turpentine, by W. C. Smith and F. P. Veitch. U. S. Department of Agriculture Circular 110; 5 cents.

Preliminary Report on the Determination of pH Values and Total Acidity in Paper, presented at the annual meeting of the Technical Association Pulp and Paper Industry, New York City, Feb. 19, 1930. U. S. Government Printing Office pamphlet.

New Rubber Specifications. Two specifications of the Federal Standard Stock Catalogue Board, as follows: ZZ-R-601, General Specifications for Physical and Chemical Examination of Rubber Goods, 10 cents; and ZZ-T-381, Pneumatic Automobile Tires, 5 cents.

Acceleration of Extraction of Soluble Copper From Leached Ores, by Morris Guggenheim and John D. Sullivan. Bureau of Mines Technical Paper 472; 10 cents.

The Price of Silver, by Herbert M. Bratter. Bureau of Foreign and Domestic Trade Information Bulletin 682; 10 cents.

Whiting or Ground Chalk and Precipitated Chalk. U. S. Tariff Commission report to the President; 10 cents.

Report of analyses of thirteenth and fourteenth government potash test holes drilled in New Mexico. U. S. Geological Survey mimeographed report, dated April 5, 1930.

The Phosphate Mines of the Gafsa Region of Tunisia, by Assistant Trade Commissioner Earle C. Taylor, Paris. Bureau of Foreign and Domestic Commerce Chemical Division Special Circular 306; mimeographed.

Grinding and Classification studies. Report of work done by A. W. Fahrenwald, issued as Bureau of Mines Reports of Investigations, in two parts, as follows: Part I, Batch Grinding, Report of Investigations 2980; and Part II, Batch Closed-Circuit Grinding, Report of Investigations 2990; mimeographed.

Sillimanite, Kyanite, Andalusite, and Dumortierite, by Alice V. Petar. Bureau of Mines Information Circular 6255; mimeographed.

Caesium, Rubidium, and Lithium, by R. M. Santmyers. Bureau of Mines Information Circular 6215; mimeographed.

Barite and Barium Products, Part II. Barium Products, by R. M. Santmyers. Bureau of Mines Information Circular 6223; mimeographed.

Phosphate Rock, Part I. General Information, by Bertrand L. Johnson. Bureau of Mines Information Circular 6256; mimeographed.

World Reserves and Resources of Tin, by Charles W. Merrill. Bureau of Mines Information Circular 6249; mimeographed.

Sensitization of Ammonium Nitrate by Nitrostarch, by G. St. J. Perrott, D. B. Gawthrop, and C. A. Taylor. Bureau of Mines Report of Investigations 2987; mimeographed.

Cracking Natural Gas in Water-Gas Generators With Recovery of Carbon Black, by Wm. W. Odell. Bureau of Mines Report of Investigations 2991; mimeographed.

Twenty-First Semi-Annual Motor Gasoline Survey, by E. C. Lane and others. Bureau of Mines Report of Investigations 2995; mimeographed.

Fake Antiseptics and the Law. Mimeographed pamphlet issued by U. S. Food, Drug, and Insecticide Administration, January, 1930.

Labeling of Sodium Hypochlorite Solutions Recommended for Use as Disinfectants. U. S. Food, Drug, and Insecticide Administration, mimeographed document, dated March 12, 1930.

Coke-Oven Accidents in the United States During the Calendar Year 1928, by W. W. Adams and L. Chenoweth. Bureau of Mines Technical Paper 408; 10 cents.

Manual of First-Aid Instruction. Bureau of Mines document, superseding Manual of First-Aid Instruction for Miners, 1921; 15 cents.

Review of Carbon Monoxide Poisoning, by R. R. Sayers and Sara J. Davenport. U. S. Public Health Service Bulletin 195; 20 cents.

Production of Explosives in the United States during the Calendar Year 1928, by W. W. Adams and L. S. Gerry. Bureau of Mines Technical Paper 467; 10 cents.

Petroleum Refinery Statistics, 1928, by C. R. Hopkins. Bureau of Mines Bulletin 318; 25 cents.

Mineral Resources of the United States, 1927, Part II. Non-metals Bureau of Mines statistical volume; $1.

Mineral production statistics for 1929—preliminary mimeographed statements from Bureau of Mines on: potash, natural sodium compounds, fluorspar, sulphur, aluminum, molybdenum, bauxite, fuel briquets, carbon black, and petroleum products, and natural gasoline.

Mineral production statistics for 1928—separate pamphlets from Bureau of Mines on: Clay, by Jefferson Middleton, 5 cents; Sand and Gravel, by Estelle R. Phillips, 5 cents; Lead and Zinc Pigments and Salts, by Elmer W. Pehrson, 5 cents; Natural Gasoline, by G. R. Hopkins and E. M. Seeley, 5 cents; Tin, by C. W. Merrill, 5 cents; Stone, by A. T. Coons, 10 cents; and Barite and Barium Products, by R. M. Santmyers and B. H. Stoddard, 5 cents.

Fertilizers. Mimeographed statistical statement from the Bureau of the Census giving preliminary 1929 totals for production, shipments, and stocks of superphosphate and production, purchases, consumption, shipment and stocks of sulphuric acid, reported by superphosphate manufacturers.

The Clay-Products Industries and Sand-Lime Brick, 1928. Census Bureau statistical document; 5 cents.

Foreign Trade of the United States in the Calendar Year 1929, by Grace A. Witherow. Bureau of Foreign and Domestic Commerce Trade Information Bulletin 684; 10 cents.

Preparing Shipments to Canada—Documentation and Customs Entry, by Mary H. Fricker. Bureau of Foreign and Domestic Commerce Trade Promotion Series 91; 10 cents.

Comparison of Imports and Consumption, 1927. U. S. Tariff Commission statistical document; 15 cents.

Preliminary Report of the Census of Dyes and Other Synthetic Organic Chemicals, 1929. U. S. Tariff Commission mimeographed release dated April 7, 1930.

Supplement to Tariff Information on Items in Tariff Bill of 1930. Compiled by the U. S. Tariff Commission. 85 cents.

EQUIPMENT NEWS
FROM MAKER AND USER

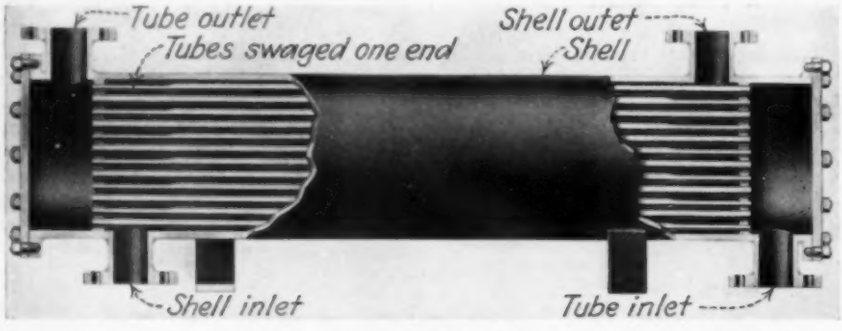
Safe Terminology

IN THE INTERESTS of safety, the International Oxygen Company, Newark, N. J., is conducting a campaign to impress upon users the desirability of referring to compressed oxygen by its proper name, rather than under the name of "air." It is pointed out that the interchangeable use of "air" and "oxygen" in this connection is not only incorrect but likely to create the impression among certain classes of users that the two are the same and interchangeable. An error in using one for the other might very possibly result seriously. Readers of *Chem. & Met.* will be furthering the cause of safety in enforcing the correct terminology.

◆

Baffle-Less Heat Exchanger

ACCORDING to the Griscom-Russell Company, 285 Madison Avenue, New York, baffles in heat exchangers are the principal cause of fouling. In order to avoid the use of baffles, this company has designed and is now marketing a new type of heat exchanger, known as the "Equaflo," which, according to the manufacturer, maintains the proper velocity of flow by close spacing of the tubes, at the same time preventing undue weakening of the metal between the holes in the tube sheet.



New Heat Exchanger Built Without Baffles Through Use of Tubes Swaged at One or Both Ends

This is accomplished by swaging down one or both ends of each tube. As a result, the hole area in the tube sheets is considerably less than would be the case if a constant tube area were maintained. It is claimed that this system permits the attainment of any desired velocity of flow outside of the tubes, entirely without the use of cross baffles.

The accompanying photograph makes this construction clear. It also shows that the close spacing of tubes permits the use of a smaller shell for a given duty. It does not show the fact that tube bundles may be made removable, if desired. This style exchanger is made in four different types, two with stationary heads and two with one floating head. In one of the latter, the tube bundle is removable.

While this exchanger has been designed primarily for heat interchange between hot and cold liquids of approximately the same quantity, it is also suitable, according to the manufacturer, for use as a condenser or cooler. The cooler liquid flows through the tubes, while the liquid to be cooled or condensed passes through the shell. The absence of baffles, it is said, gives this exchanger a lower pressure drop than is experienced in comparable baffled equipment.

◆

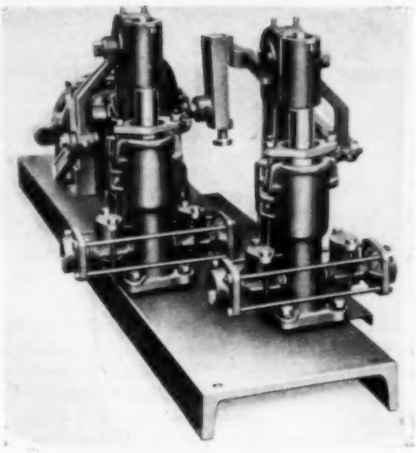
Dual Drive Welder

A NEW arc welder, which is operated either by means of a gasoline engine or a motor, has been introduced by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The unit consists of a 300-ampere, single-operator, welding generator, a 15 hp. a.c. motor operating either at 220 or 440 volts, and a 6-cylinder gas engine, mounted in tandem on a steel base. Either the motor or the engine may be used by the engaging of a clutch. It is pointed out that the dual drive feature results in additional flexibility in the use of the welder over that of a machine driven by either motor or engine alone.

◆

Proportioning Pump

FOR RESISTANCE to sulphuric acid of any concentration, the Hills-McCanna Company, 2,341 Nelson Street, Chicago, Ill., has developed a new Duriron-fitted proportioning pump, which is known as Type G. The pump consists of a lead-covered base, upon which is mounted a motor directly connected through reduction gears to pumping units driven by means of variable-stroke cranks. It is stated that stroke adjustment may be made while the pump is in operation.



Self-Contained, Duriron-Fitted Proportioning Pump

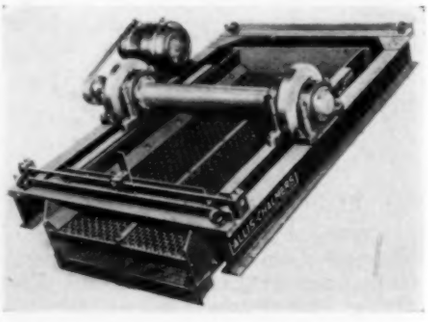
All parts of the pump which come in contact with the acid are constructed of Duriron, including the check valves. The pump units are entirely separate, having independent suction and discharge connections. The pump may be furnished in single or dual units, both single and dual pumps being provided in standard sizes of 1, 2 and 3 in.

◆

Vibrating Screen

MECHANICALLY produced vibration, which is transmitted equally all over the entire screen body, is a feature of a new centrifugal vibrating screen produced by the Allis-Chalmers Manufacturing Company, Milwaukee, Wis. Vibration is produced by the eccentric suspension of the screen from a rotating shaft. Self-aligning, anti-

Centrifugal Vibrating Screen, Showing Rugged Construction and Method of Vibrating



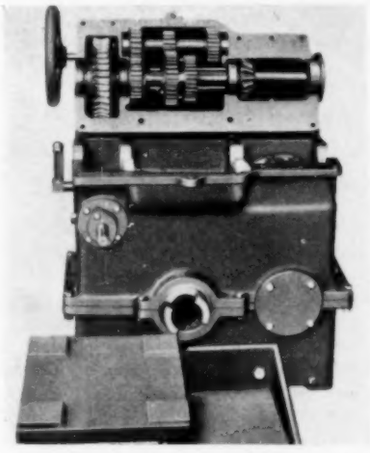
friction, roller-type bearings transmit the motion of the eccentric to the screen. The shaft itself is driven by an Allis-Chalmers closed, fan-cooled, squirrel-cage motor, equipped with anti-friction bearings and driving through a Texrope drive.

This type of screen is made in various sizes, and is supplied with single or multiple decks. The screen surfaces are easily removed and replaced. The screening angle may be readily adjusted to suit different operating conditions.

◆

Three-Speed Drive

FOR USE primarily in connection with automatic stoker drives, Gears & Forgings, Inc., Cleveland, Ohio, has developed a three-speed reducer. The high-speed shaft carries a worm which meshes with a worm gear driving the change speed mechanism. The latter mechanism is similar in principle to the selective type of sliding-gear transmission used in automobiles. Its construction is evident from the accompanying photograph. A splined shaft, which is in line with the worm-gear shaft, carries two sliding gears and a clutch. A hand-wheel operating a threaded shaft moves the shifter fork so that the



Three-Speed Reducer Opened to Show Change Gear Mechanism

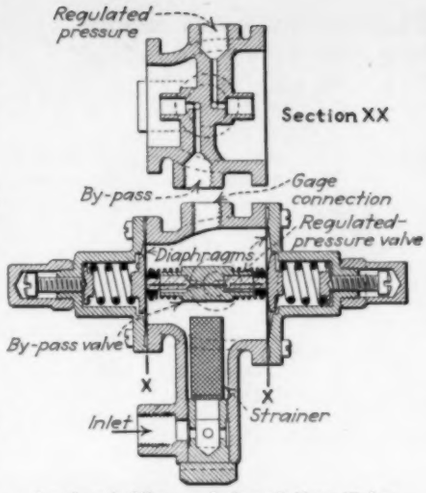
clutch may be engaged to link the worm gear and splined shaft for direct drive; or one or the other of the sliding gears may be meshed with the fixed gears on the jack shaft.

The housing is of semi-steel. All gears are of heat-treated, carburized steel.

◆

Duplex Regulating Valve

AN ACCOMPANYING drawing shows two cross-sectional views of a new regulating valve for liquid flow. This valve, originally designed by its manufacturer, the Monarch Manufacturing Works, Inc., 2730 East Westmoreland Street, Philadelphia, Pa., for use with oil burners, is suggested also for other liquids where the pressure must be controlled accurately in the range from 100 to 150 lb. pressure, at capacities up to 90 gal. per hour.



Sectional Views of Regulating Valve for Liquids, With Bypass to Prevent Excess Pressure

Liquid enters the bottom of the valve, passing upward through a strainer. Pressure is exerted upon the two diaphragms, the larger one at the right opening its valve to deliver liquid at the controlled pressure. If delivery to the valve exceeds the quantity for which the valve is set, the diaphragm at the left opens its valve and bypasses liquid back to the reservoir or pump suction. Pressure at which each diaphragm valve will open is regulated by means of the adjusting screws at the sides. The adjustment is such that no liquid will discharge from the valve until a given minimum pressure is developed. Above a given maximum, the bypass opens. Thus the valve prevents delivery of liquid except in a controlled pressure range.

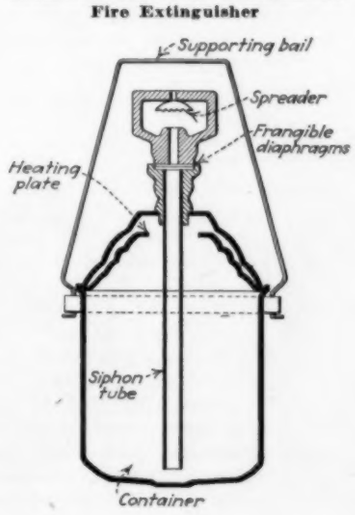
At present the valve is made in the ⅜-in. size. Aluminum, zinc, Monel metal, brass, and other metals, as required, may be used in its construction.

◆

Automatic Fire Extinguisher

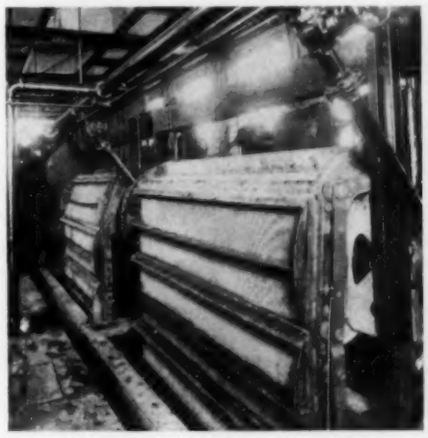
IN ORDER to provide automatic fire protection in the absence of sprinkler systems, Automatic Equipment Company, Attleboro, Mass., is now marketing a new type of automatic extinguisher under the name of "Firetox." Reference to the drawing reproduced herewith will indicate clearly the method of operation. Each extinguisher is a separate unit, requiring no piping or control valves. Units usually are installed on 10-ft. centers, so that the spread of the discharge covers the entire protected area.

Cross-Sectional View of Automatic Fire Extinguisher



The extinguisher unit consists of a container holding two quarts of a special extinguishing liquid and one pint of a readily volatile compound which is used to discharge the extinguishing liquid. When fire occurs in the protected area, the volatile compound expands, increasing the pressure, until at a predetermined temperature, the frangible disks shown in the drawings are blown out and the extinguishing compound is forced up the siphon tube and sprayed from the spreader. The extinguishing liquid is said to volatilize rapidly in contact with the fire, forming a gas blanket about five times the weight of air.

◆



View Showing How Separate Screen Baskets Are Carried on Roller Chain

Traveling Water Screen

INDUSTRIES which use considerable quantities of river water for process and cooling purposes usually find it necessary to screen the water before use, to remove leaves, insects, and trash. Traveling screens are desirable for this purpose where the quantity of material to be removed from the water is considerable. Such a screen is being placed on the market by the Chain Belt Company, Milwaukee, Wis. It consists of a number of rectangular baskets made of screen cloth which are carried upon two strands of steel roller chain. The chain operates over head and foot sprockets. As the submerged screen surface becomes matted with refuse, the screen is revolved and the refuse lifted in the baskets, which are then automatically flushed by means of a powerful spray, while the refuse is sluiced away for disposal, usually on the downstream side of the plant. Through the use of a new design of foot wheel, the rollers are engaged at the lower end of travel by means of a track shoe, preventing the formation of any intervening space between the ends of the basket and the

frame of the screen. This is said to insure thorough screening and prevent short-circuiting.

◆

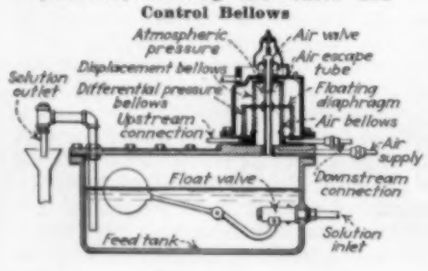
Proportioner for Corrosive Solutions

FOR USE wherever a small quantity of liquid must be added continuously to another liquid and in constant proportion to the flow of the latter, the Cochrane Corporation, North Philadelphia, Pa., has developed a proportioner which is governed by means of the pressure differential due to the flow of the primary liquid. This device is known as an air-balanced proportioner and is so constructed that its delicate parts are not subjected to corrosive fumes in the event that materials such as sulphuric acid are to be used.

Referring to the sectional view, we see that the corrosive solution is held at a constant level in the feed tank by means of a float valve. Solution is discharged from the feed tank through an orifice by means of air pressure, which pressure is adjusted, as will be described, by means of the amount of flow of the primary liquid. This adjustment is accomplished through the balancing device at the right, consisting of three metal bellows, all attached to a single diaphragm whose position is transmitted to a valve at the top. The portion of the diaphragm between the inner bellows and the upper is acted upon by atmospheric pressure above and by the air pressure within the feed tank below. Of the portion of the diaphragm between the coaxial bellows, that above the diaphragm is acted upon by the upstream pressure of the orifice in the primary flow pipe, while the under-side is acted upon by the pressure on the downstream side of the same orifice. The differential pressure is thus balanced against that within the orifice feed tank. If the latter should be too great, the valve member will rise and permit some of the air to escape. Conversely, if it should be too small, the valve will close until air pressure within the feed tank is built up to the proper degree. In actual operation, a balance is reached where some air leakage occurs constantly, and pressure in the feed tank is sufficient to feed the solution constantly at the proper rate.

Discharge from the feed tank is then led through a funnel and pipe to the mixing apparatus, where air or mechanical agitation is used to insure the mixing of the solution with the primary liquid.

Sectional View of Air-Balanced Proportioner, Showing Air Valve and Control Bellows



Plastic Chromite Cement

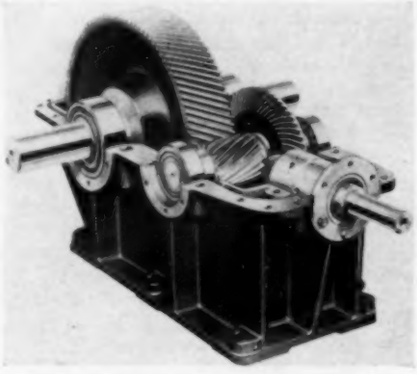
MARKETED under the name of Adachrome Plastic Super-Cement by the Botfield Refractories Company, Swanson and Clymer Streets, Philadelphia, Pa., is a new high-temperature product said by its makers to be the only chrome cement sold in plastic form and ready for use. It is recommended for laying up fireclay, silica, chrome, and high alumina brick. It is also said to be of use with magnesite brick under certain conditions.

This cement is credited with high resistance to basic and acid slags, molten metal penetration, and abrasion and erosion. It is marketed in drums of 250 and 500 lb. capacity.

◆

Right-Angle Drive

REDUCTION ratios from 1.5-1 to 518-1 are available in a new line of right-angle-drive speed reducers recently announced by the Falk Corporation, Milwaukee, Wis. Included in this new line are reducers with both horizontal and vertical shafts. As shown in the illustration, these drives make use of a spur gear reduction in conjunction with a bevel reduction, the latter being responsible for the right-angle feature. The spur gears are of the single helical type, and the right-angle combination, of spiral bevel gears. High efficiency is claimed for the machine.



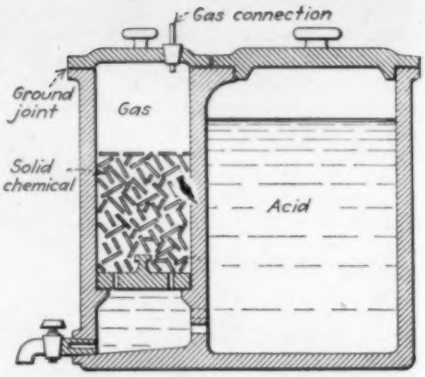
New Right Angle Reducer With Top Removed to Show Gearing

Ratings on the new line range from 1/16 hp. per 100 r.p.m. on the smallest unit to 565 hp. at 100 r.p.m. on the largest.

◆

Gas Generator

AN ACCOMPANYING cross-sectional drawing shows the principle of operation of the new "U. S. Standard" gas generator which has been placed on the market by the U. S. Stoneware Company, 50 Church Street, New York City. This generator is being made in five standard sizes, the two smaller of which are intended principally for laboratory installations and the three larger for small plant and semi-plant operation. The outfit consists of a single rectangular chemical stoneware container which is divided into two compartments by a vertical partition. The larger compartment, which is connected with the smaller by means of perforations at the bottom of the partition, is intended to contain acid, and the other, the solid sulphide, carbonate or other reacting substance, which is supported upon a removable, perforated plate of chemical stoneware.



Cross-Sectional View of Chemical Stoneware Gas Generator

As gas is generated it is withdrawn from a connection made to the gas-tight cover of the reaction compartment. If gas supply increases more rapidly than the demand, pressure builds up in the gas compartment and forces the acid out and into the acid reservoir, thus stopping the reaction.

◆

Improved Orsats

A NEW and improved line of gas analyzers is being marketed by the Hays Corporation, Michigan City, Ind. This is being built in six standard ranges available in lightweight, metal carrying cases weighing only 8 lb. complete. Three additional special ranges are available in slightly larger cases.

These instruments are similar in principle to the usual Orsat analyzer. They feature, however, quick operation and extreme lightness. The chemical bottles for absorbing carbon dioxide, carbon monoxide and oxygen are of molded hard rubber filled with steel wool, said to permit a complete analysis in four to five minutes. Monel metal needle valves replace the usual glass stopcocks and pinch clamps. The method of mounting the few glass parts is said to result in practical elimination of the danger of breakage.

◆

Vapor Degreaser

AN APPARATUS for degreasing metal and other products prior to plating, enameling or other finishing operations, has been announced by the Carrier Engineering Corporation, Newark, N. J. In this process the material to be degreased is suspended in a bath of the vapor from one of a class of chlorinated solvents known under the trade name of Cecolene. The vapor, being much heavier than air, has no tendency to overflow but fills the container in which the parts to be cleaned are placed and condenses in contact

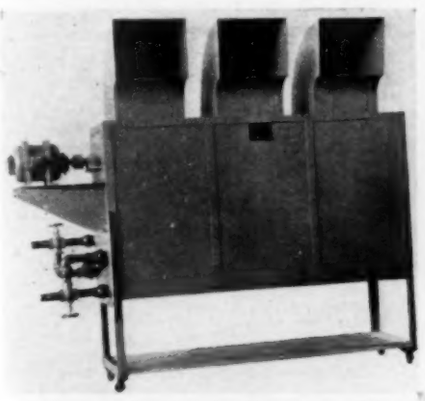
with water-cooled condensers around the sides of the container and in contact with the cold objects being cleaned. It is claimed that the condensate carries all dirt and grease to the bottom of the tank, where it remains in the liquid without danger of vaporization. The device is adaptable to gas, steam or electric heating.

◆

Blast Cooling Equipment

FOR THE PRODUCTION of moderate cooling where precise control of humidity is not required, the Niagara Blower Company, 673 Ontario Street, Buffalo, N. Y., has announced new fan coolers and standard cooling surfaces. These, it should be noted, are intended for room cooling and process applications, rather than for the attainment of extremely low temperature for refrigeration and freezing.

As shown in the photograph, the fan cooler consists of a structural frame inclosed in a casing within which is mounted the cooling surface and the fan. The surface consists of standard ¾-in. pipe into which a fin is inserted in a spiral groove and knurled to the steel. The exterior of the pipe and fin is thoroughly tinned. Tubes are welded to the header plate to relieve the tubes of all expansion strains. A drip pan and



Fan Cooler for Cooling Air for Rooms or Process Applications

drain are provided for the removal of condensed moisture.

For larger capacity installations, Niagara standard cooling sections in casings are available. The cooling surface is the same type used in the fan cooler. Coils are assembled into casings of standard dimensions. The coils are rated at 250 lb. working pressure. A special feature of this equipment permits the reversing of the brine and air flow for defrosting.

◆

Electrical Equipment

TWO new pieces of switch equipment are announced by Cutler-Hammer, Inc., Milwaukee, Wis. One is a small thermal-overload switch for fractional horsepower motors. It is designated Bulletin 9,101. It is equipped with push buttons for starting and stopping and a time-limit type of thermal overload cut-out for numerous ratings up to and including ¾ hp. a.c., and ¼ hp. d.c. This switch is reset after an overload by pressing the start button.

The second switch is actuated by pressure. It is designated Bulletin 10,006, and is used as a starting switch for motors up to 1 hp. and 230 volts, or as a pilot switch in the control circuit of automatic starters for larger motors. It closes the circuit at low pressure and opens the circuit at high pressure. It can be adjusted to disconnect at any pressure from 30 to 200 lb. It may be used to maintain pressure on water, air, gas, and similar fluid systems. Construction is designed to resist moist atmosphere.

◆

High Strength Welding Rod

OXWELD Acetylene Company, 30 East 42d Street, New York, has placed on the market a welding rod intended for making extremely strong welds in steel. This is designated "Oxweld No. 22 S.D." and has been developed especially to meet the demand for joints in steel pipe having a carbon content of 0.30 to 0.40 per cent. It is somewhat similar to this company's "Oxweld No. 1 High Test Rod," but is said to produce welds of higher tensile strength. This rod is self fluxing and deoxidizing, producing a fusible flag which gives surface protection and prevents the burning out of carbon during the welding operation. It is available in 36-in. rod, $\frac{5}{32}$ and ¼ in. in diameter.

◆

Thermostatic Steam Trap

THREE IMPROVEMENTS are announced by the Sarco Company, 183 Madison Avenue, New York, in its No. 9 steam trap. The bellows containing the thermostatic fluid has been lengthened from 10 to 14 corrugations. This is said to minimize wear and increase life. As a further protection, the bellow has now been encased in a heavy brass shield. A third improvement is the use of self-centering valve heads. To avoid the possibility of inaccurate closing, the new heads are made to move freely so as to center perfectly in the seat. This is said to eliminate the possibility of steam escaping due to misalignment.

◆

Chain and Loading Equipment

TWO new developments are announced by the Link-Belt Company. The first, made by its Indianapolis (Ind.) plant, is a new form of steel drive-chain known as Hyper chain. This is made from alloy steel, heat-treated, and makes use of a new type of pin and cotter. Parts are accurately ground, while the cotters are of a special type which, according to the manufacturer, cannot work loose. The new chain is sold in two sizes, having an ultimate strength of 75,000 lb. and 150,000 lb. respectively.

A second development, announced by the Philadelphia plant of the company, is a high-capacity crawler bucket loader, known as the "Grizzly 1930 Model." The photograph shows this machine, which consists of a bucket elevator, fed by means of a spiral digger, the whole mounted upon a motor-driven crawler. The digger is said to be self-sharpening and to convey material to the elevator in a smooth, continuous stream.

New 1930 "Grizzly" Loader in Operation

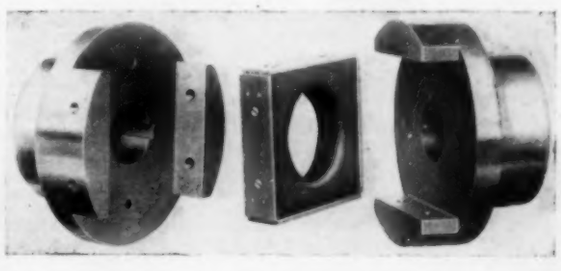
This machine is rated at 1¼ cu.yd. per minute on materials such as sand, stone and gravel, coke and similar materials. It is powered by means of a 50-hp. gasoline engine or a 20-hp. electric motor.

◆

Flexible Coupling

WITHOUT being made of flexible materials, a new flexible coupling of its manufacture is nevertheless stated by the American Flexible Coupling Company, Erie, Pa., to provide maximum flexibility in the connection between possibly misaligned shafts. The accompanying photograph shows the three principal parts which compose this coupling. Two flange sections, identical and interchangeable except for the bore diameters, which are made to suit the shafts, and a floating center member, the edges of which are faced with replaceable bearing strips, constitute these parts. The center member is a square, hollow casting with a hole in the center which provides clear-

Three Principal Parts Only Constitute This Flexible Coupling



ance for the shaft ends. The bearing strips are made from a non-metallic compound such as is used in non-metallic gears and pinions. The flange sections are single castings with a wide groove machined in the face, leaving two jaws between which the floating member slides and by which the power is transmitted.

The couplings may be removed without special tools, while the bearing strips are replaced quickly without dismounting the couplings. Lubrication of the bearing strips is provided by a charge of grease held within the hollow floating member and feeding out to the bearing surfaces through wicks, assisted by centrifugal force.

Manufacturers' Latest Publications

Activated Carbon. Industrial Chemical Sales Co., 230 Park Ave., New York.—35-page book by C. L. Mantell, Ph.D., describing history, properties and characteristics of activated carbons, technology of use, applications in connection with a large number of chemicals, oils and miscellaneous materials and a section devoted to the particular series of carbons known as "Nuchar" made by this company.

Buildings. Master Builders Co., 7016 Euclid Ave., Cleveland, Ohio.—Folder No. 2—Looseleaf folder describing materials for waterproofing and damp-proofing with complete descriptions and detailed specifications.

Chemicals. Diamond Alkali Co., Pittsburgh, Pa.—Second edition of the "Diamond Alkali Handbook," describing the company's facilities and products, and giving tables, charts and formulas for use in connection with alkalies and chlorine; 72 pages.

Chemicals. Quaker City Chemical Co., 2738 No. Broad St., Philadelphia, Pa.—Pocket booklet of information concerning chemicals for textile industries. Also other information useful to textile manufacturers.

Cleaning. Schutte & Koerting Co., 12th and Thompson Sts., Philadelphia, Pa.—Bulletin 4-T—Describing a compressed-air ejector nozzle or blow gun for use in dusting and cleaning operations.

Compressed Air. Sullivan Machinery Co., 400 N. Michigan Ave., Chicago, Ill.—Folder describing "Tannergas," a material for the prevention of freezing in compressed air lines.

Conveyors. Stearns Conveyor Co., Cleveland, Ohio—New Catalog of "Rex-Stearns" anti-friction belt conveyor idlers and accessories.

Disintegration. Fuller Lehigh Co., Fullerton, Pa.—Bulletin 902—Describes the air-separation pulverizing mills made by this company.

Electrical Equipment. Century Electric Co., 1806 Pine St., St. Louis, Mo.—Bulletin 13-1—Describes a multi-speed squirrel cage induction polyphase motor.

Electrical Equipment. Crouse-Hinds Co., Syracuse, N. Y.—Catalog 312, 52-page book on floodlights and industrial lighting units. Also Bulletin 2201, describing a new floodlight for many uses.

Electrical Equipment. General Electric Co., Schenectady, N. Y.—Publications as follows: GEA-286C, outdoor switching equipment; GEA-556C, automatic welding head and control; GEA-588C, centrifugal compressors, geared units; GEA-817A, battery-charging equipment for electric trucks, etc.; GEA-925A, station oil circuit breakers; GEA-959A, oil circuit breakers; GEA-995A, 40 page booklet on arc welding in industry; GEA-1011A, 12 page booklet on steam turbines; GEA-1117, solid-shaft, vertical induction motors; GEA-1157A, strip heaters; GEA-1186, hook-operated disconnecting switches; GEA-1197, back-connected, dead-front brush-contact switches; GEA-1199, automatic switching equipment; GEA-1200, air circuit breakers; GEA-1202, capacitor motors; GEA-1236, Fabroil gears; GEA-1242, Textolite gears; GEA-1247, enclosed starting rheostats; also booklet on flood lighting entitled "Architecture of the Night," and the company's annual report for 1929.

Engineering Consultation. Whiting-Swenson Co., 303 So. State St., Ann Arbor, Mich.—Leaflet briefly describing the engineering and research services offered by this company.

Equipment. Bethlehem Foundry & Machine Co., Bethlehem, Pa.—Bulletin F-16—A folder describing the use of the Wedge mechanical furnace for the revivification of filter aids in the sugar refinery.

Equipment. Coppus Engineering Corp., Worcester, Mass.—Bulletin 120-2—8-page booklet describing equipment for oil refineries including turbines, turbine generators, blowers and small portable fan units for cooling operators and equipment.

Equipment. The Thermal Syndicate, Ltd., Schenectady and Atlantic Aves., Brooklyn, N. Y.—68 page catalog with bibliography on fused silica, discussing a large number of types of Vitreosil equipment for laboratory use.

Exhaust Fans. United States Pipe & Foundry Co., Burlington, N. J.—Bulletins 116 and 117, describing respectively the acid-proof exhaust fans made by this company and the use of such fans in connection with fume absorption systems.

Filtration. Pacatome, Inc., Kohl Building, San Francisco, Calif.—Bulletin describing the production of Pacatome "Filterpac," a new filter aid, and its use in the sugar refinery.

Furnaces. Ajax Electrothermic Corp., Trenton, N. J.—Bulletin 6—New 12-page booklet describing construction and application of coreless induction furnaces.

Furnaces. Quigley Furnace Specialties Co., 56 W. 45th St., New York.—24-page bulletin entitled "Hytempite in the Power Plant," describing the use of this plastic refractory material in construction and repair of boiler settings and furnaces and describing the use of the Quigley refractory gun.

Heat Exchange. Schutte & Koerting Co., 12th and Thompson Sts., Philadelphia, Pa.—Bulletin 12-H—Describing single and multipass heat exchangers and vapor condensers.

Heating. American Blower Corp., Detroit, Mich.—Bulletin 9218—44-page booklet with illustrations and engineering data concerning Venturafin heaters for floor, wall and ceiling mounting.

Instruments. Esterline-Angus Co., Indianapolis, Ind.—Bulletin 330—Describes the construction and use of graphic time recorders.

Instruments. Leeds & Northrop Co., 4901 Stenton Ave., Philadelphia, Pa.—Publications as follows: Catalog 20, 40 pages on galvanometers; Bulletin 536, describes a power cable fault bridge; Bulletin 660, 32 pages on metered combustion control; Bulletin 781, 24 pages on electrical CO_2 meters; Bulletin 950, Homo method applied to nitriding of steel.

Instruments. Republic Flow Meters Co., 2240 Diversey Pkwy., Chicago, Ill.—Bulletin G-10—"Republic Economy in Industry," a 68-page book describing the purpose, application and use of instruments in various industries; also describing the operation and construction of the instruments made by this company.

Instruments. Roller-Smith Co., 233 Broadway, New York.—Bulletin 830—Announcing new graphic instruments for recording voltage and amperage of alternating and direct current.

Instruments. Thwing Instrument Co., 3339 Lancaster Ave., Philadelphia, Pa.—Bulletin 10—22-page book describing thermoelectric pyrometers and accessories; also folders as follows: Bulletin 16, describing the "Treasure Chest," a potentiometric checking set for pyrometers; Bulletin F-93 describing a two-record pyrometer recorder.

Materials Handling. American Manganese Steel Co., Chicago Heights, Ill.—Folder describing manganese steel crawler equipment including links and sprockets.

Materials Handling. Cleveland Electric Tramrail Division, Cleveland Crane and Engineering Co., Wickliffe, Ohio.—Folders describing the use of Tramrails in warehousing, ceramic industries, foundry industries, handling of containers and packages, and the standardized parts that are used in Tramrail systems.

Metals and Alloys. The Duriron Co., Dayton, Ohio—Bulletin 501—Describes the properties, applications and fabrication of Durimet.

Metals and Alloys. International Nickel Co., 67 Wall St., New York.—36-page pocket booklet entitled "Notes on Uses of Nickel Cast Iron," summarizing briefly use of this material in five industries. Also Nickel Steel Bulletins Nos. 15 and 16, discussing respectively nickel-chromium steels for high temperature service and relations between various hardness measurements and the tensile strength of structural alloy steels.

Metals and Alloys. Ludlum Steel Co., Watervliet, N. Y.—Catalog binder and 24-page general catalog of carbon and alloy tool steels, corrosion, heat and wear resisting steels, valve steels and Strauss metal. Also 48-page catalog on tool steels and 36-page booklet of reference material in connection with steel treating. Detailed catalogs on other classifications to be issued later.

Metal Cleaning. Bullard-Dunn Process Division, The Bullard Co., Bridgeport, Conn.—Booklet describing the new Bullard-Dunn electrochemical cleaning process for the removal of scale, oxide and other foreign matter from the surface of metals without pitting, etching, or hydrogen embrittlement. The surface is said to be cleaned by hydrogen evolved electrically at the cathode in an aqueous solution. The metal is said to be protected from pitting and hydrogen embrittlement by a deposit of an homogenous metal coating.

Power Transmission. W. A. Jones Foundry & Machine Co., 4401 Roosevelt Rd., Chicago, Ill.—Catalog 45—80-page catalog of herringbone speed reducers and flexible couplings; also includes a large number of installation photographs.

Protection. Hercules Powder Co., Wilmington, Del.—"The Story of Modern Lacquer," attractively illustrated booklet describing new uses for lacquers.

Protection. Inertol Co., 253 Broadway, New York.—Leaflet describing Imunol, a material for the protection of gas holders.

Pumps. Barrett, Haentjens & Co., Hazleton, Pa.—Bound loose leaf publications as follows: Bulletin 501, centrifugal pump priming; Bulletin 505, priming submerged pumps; Bulletin 509, pumps primed with foot valves; Bulletin 512, priming with ejectors; Bulletin 515, priming by hand; Bulletin 520, vacuum pump priming; Bulletin 922, power primers.

Pumps. Chicago Pump Co., 2336 Wolfram St., Chicago, Ill.—Pump Guide No. 12—48-page booklet giving engineering data on pumps made by this company, as well as considerable information for use in determining pump requirements.

Pumps. Croll-Reynolds Co., 17 John St., New York. Catalog 102—14-page book describes steam jet air pumps with complete details and engineering data.

Pumps. De Laval Steam Turbine Co., Trenton, N. J.—28-page booklet describing a number of successful Canadian pumping stations installed by this company.

Pumps. Hills-McCanna Co., 2349 Nelson St., Chicago, Ill.—Booklet describing three standard and several special types of proportioning pump

Refractories. A. P. Green Fire Brick Co., Mexico, Mo.—20-page booklet describing with illustrations a complete new tunnel kiln plant of this company.

Refrigeration. York Ice Machinery Corp., York, Pa.—Bulletin 146-A—16-page booklet briefly describing constructional features and dimensions of vertical, single-acting ammonia compressors made by this company.

Sifting. Robinson Mfg. Co., Muncy, Pa.—Bulletin 40-A—12-page catalog of reels, cylindrical screens and brush sifters, made by this company.

Soldering. D. E. Makepeace Co., Attleboro, Mass.—23-page booklet of useful information on gold and silver solders. Also tables of engineering data.

Spectrophotometer. American Photoelectric Corp., 149 Broadway, New York.—Bulletin 101—Describes three forms of photoelectric spectrophotometer for analyzing the emitted, transmitted, or reflected radiation in connection with solids and liquids. Also a reprint describing the same instruments with particular reference to oils.

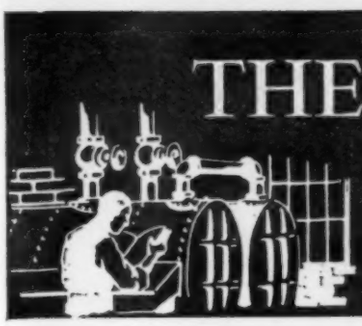
Steam Generation. E. H. Wheeler Mfg. Co., Philadelphia, Pa.—130-page book on steam condensers, taking up this subject very thoroughly from the standpoint of both jet and surface condensers as well as auxiliaries. Also 37-page book treating of water cooling, with particular reference to water cooling towers. Both books give considerable engineering data.

Tanks. Lancaster Iron Works, Lancaster, Pa.—Handbook on steel tanks, 91 pages, containing a great deal of engineering information and data in connection with design and installation of tanks; also specifications on steels for various purposes, fire protection and insurance requirements, and specifications of standard sizes and capacities.

Water Treatment. Elgin Softener Corp., Elgin, Ill.—Bulletin 120—"The Economy of Soft Water," a 15-page non-technical discussion of Zeolite water softening.

Welding. Alloy Welding Processes, Ltd., Ferry Lane Works, Forest Road, London, E. 17, England—Bulletin 62—16-page booklet showing many photomicrographs of welds using different types of electrode made by this company.

Welding. Fusion Welding Corp., 103d St. and Torrence Ave., Chicago, Ill.—Form A-43—Lists completely the line of "Weldite" welding rods. Over 40 different rods are grouped by type of service.

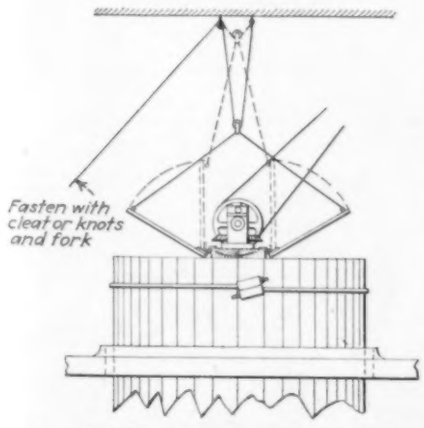


THE PLANT NOTEBOOK

Quick Open-and-Shut Lid for Vats

By Louis E. Brunner
Operating Chemist
Watseka, Ill.

MANY heating and boiling operations carried out in open vats may be materially speeded up if the vat is covered. It is the writer's experience, particularly where the boiling is violent and it may be necessary for the operator to open the vat occasionally to watch the progress of the reaction, that a device such as is illustrated in the drawing shown herewith, is a saving in time as well as a real safety measure. When the vat is fitted with the usual type of cover, stationary except for a small hinged lid, the operator very possibly may be scalded by the outrushing steam when the lid is raised. Also there is a time factor entering, as



Rope and Pulley Arrangement for Lifting Simultaneously Double Lids on Vat

the small opening permits the dissipation of steam only rather slowly.

Such a cover as is shown in the drawing may be constructed of light wood, hinged at both sides to the cross beam which supports the agitator drive. The simple arrangement of ropes and pulleys shown permits the operator to lift both lids simultaneously, at the same time keeping well away from the vat to avoid being burned. A single cleat may be used for fastening the rope or a somewhat more convenient arrangement is to have a number of knots in the rope, which may be caught in a fork attached to the vat side or some other convenient point.

Meter Prover for Very Slow Rates of Flow

By A. Lawrence Hodges
Design Engineer
Baltimore, Md.

SOME TIME AGO it was necessary for the writer to devise a scheme for calibrating gas meters at very slow rates of flow. Simple water displacement was found to be so variable, due to changing head, that it was discarded as a possible method. However, it seemed probable that the use of a floating siphon as a head controller might cure this difficulty, and construction of an apparatus similar to the one shown in the accompanying drawing was the writer's next step. As far as he knows, this use of a floating siphon is new.

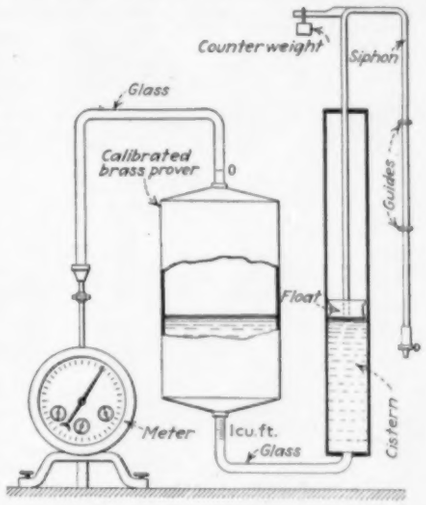
It will be noticed that the apparatus consists of a calibrated brass cylinder, or "prover," attached at the top by means of glass tubing and metal pipe to the meter under test. A second glass tube attached to the bottom of the prover cylinder leads to the bottom of a cistern of smaller diameter, in which is a float carrying the short, or submerged, end of a siphon. A stopcock or pinchcock at the outer end of the siphon is used to adjust the rate of flow; or an alternate method is to change the distance the inner end of the tube extends through the float.

If possible, for convenience, the prover cylinder should be very slightly smaller than 1 cu.ft. in capacity. On the other hand, it may be of any known volume, if sufficiently large to give the desired accuracy, and readings obtained by its use may later be converted to cubic feet or other units. In calibrating the prover, a zero point is marked on the glass tube above the cylinder and a second index point, such as 1 cu.ft., on the tube below.

Operation of the device is simple. After a preliminary test to determine the approximately correct setting of the siphon stopcock for the desired rate of flow, the apparatus is filled with water somewhat above the zero point. Then the flow is started, being timed with a stop watch between the point where the water level passes zero and the 1-cu.ft. mark below the prover.

In order to attain accuracy, it is essential that the two cylinders be of constant cross-section, although not each of the same diameter. It will be noticed that in the case of the prover shown in the drawing, the brass cylinder is made slightly convergent at either end, in order to insure complete evacuation of the water. The volume inclosed in the converging sections is so small in comparison with the total cylinder that the inaccuracy introduced from this cause is negligible. However, a finer instrument could be built to obtain complete evacuation without the convergence.

In some slow-rate meters it is found that there is a slight difference between



Accurate Prover for Slow-Flow Meters Insures Constant Flow With Floating Siphon

a calibration made with pulled air and with pushed air. This same apparatus may be used for pushed air by removing the siphon and float system entirely, emptying out all of the water, and letting a spigot, cracked to a small stream, run directly into the siphon cistern. Care must be taken, however, if the results are to be accurate, to see that the flow from the spigot is constant and not varied by change in line pressure or by swelling of the spigot washer.

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Welding Commercial Copper

It has recently been pointed out that the most satisfactory method of fabricating or making repairs by fusion welding in commercial copper apparatus is by use of bronze welding rod. Using copper rod, a zone of reduced strength appears adjacent to the weld unless specially deoxidized metal is used for the body of the apparatus.

PATENTS ISSUED

April 1 to April 29, 1930

Pulp, Paper, Glass, and Sugar

Defecation of Sugar Juice. Arthur W. Bull, New York, N. Y., assignor to Dorr Company, New York, N. Y.—1,752,781.

Paper and Paper Making. Ernest Lionne, Swampscott, Mass.—1,752,802.

Apparatus for Handling Paper Pulp. Fred B. Chappell, Glens Falls, N. Y., assignor of one-half to Glens Falls Machine Works, Glens Falls, N. Y., a Corporation of New York.—1,752,886.

Apparatus for Drawing Sheet Glass. Howard L. Halbach, Clarksburg, W. Va., assignor to Pittsburgh Plate Glass Company.—1,753,291.

Glass-Fabricating Mechanism. Everett O. Hiller, Hartford, Conn., assignor to Hartford-Empire Company, Hartford, Conn. —1,753,655.

Method and Apparatus for Drawing Sheet Glass. John L. Drake, Toledo, Ohio, assignor to Libby-Owens Glass Company, Toledo, Ohio.—1,753,743.

Sheet-Glass Apparatus. Mike Zadorozny, Charleston, W. Va., assignor to Libby-Owens Glass Company, Toledo, Ohio.—1,753,766.

Method of Sizing Paper Pulp. Judson A. De Cew, Mount Vernon, N. Y., assignor to Process Engineers, Inc., New York, N. Y. —1,753,775.

Method for Producing Sheet Glass. Enoch T. Ferngren, Toledo, Ohio, assignor to Libby-Owens Glass Company, Toledo, Ohio. —1,753,779.

Vat for Paper-Making Machines. William H. Millspaugh, Sandusky, Ohio, assignor to Paper & Textile Machinery Company, Sandusky, Ohio.—1,753,800.

Apparatus for Making Composite Glass. John H. Fox and William Owen, Pittsburgh, Pa., assignors to Pittsburgh Plate Glass Company.—1,754,853.

Manufacture of Sugar. Arthur W. Bull, Naugatuck, Conn., assignor to Dorr Company, New York, N. Y.—1,755,165.

Method for Removing Defects of Joinder from Composite Glass Plates. James H. Sherts, Glen Ridge, N. J., and William O. Lytle, New Kensington, Pa., assignors to Duplate Corporation.—1,755,274.

Feeding Molten Glass. Karl E. Peiler, West Hartford, Conn., assignor to Hartford-Empire Company, Hartford, Conn.—1,755,-792.

Rubber, Rayon, and Plastics

Composition of Matter and Method of Its Preparation. Frank Sigfrid Malm, Chicago, Ill., assignor to Western Electric Company, Inc., New York, N. Y.—1,752,531.

Molding Compound and Its Method of Production. Harry Stirling Snell, La Grange, Ill., assignor to Western Electric Company, Incorporated, New York, N. Y.— 1,752,580.

Process for Producing Cellulose Acetate. Arthur Russell, Baltimore, Md., and Joseph F. Hegeman, New York, N. Y.—1,752,853.

Solvent-Recovery Apparatus for Rubber-Spreading Machines. Ernest Arent Abeles, New York, N. Y.—1,752,875.

Moldable Composition. Adam Hoche, Lynn, Mass., assignor to Litmo Adhesive & Products Company, Lynn, Mass.—1,753,-010.

Treating Vulcanized Oils. Allen F. Owen, Jackson Heights, N. Y., assignor to Naugatuck Chemical Company, Naugatuck, Conn.—1,753,018.

Phenol-Carbohydrate Resin and Method of Making Same. James McIntosh, Norristown, Pa., assignor, by mesne assignments, to Continental-Diamond Fibre Company, Newark, Del.—1,753,030.

Process and Apparatus for the Manufacture of Artificial Threads of Derivatives of Cellulose. Konrad Hoffman, Kreis Heinsburg, Germany.—1,754,427.

Process of Conditioning Cellulosic Fiber for the Manufacture of Rayon. George A. Richter, Berlin, N. H., assignor to Brown Company, Berlin, N. H.—1,754,437.

Purifying and Concentrating Latex. William B. Westcott, Boston, Mass., assignor to Rubber Latex Research Corporation, Boston, Mass.—1,754,535.

Aldol Condensation Product and Vulcanization of Caoutchouc Therewith. Lorin B. Sebrell, Akron, Ohio, assignor to Goodyear Tire & Rubber Company, Akron, Ohio. —1,754,865.

Dispersed Vulcanized Rubber. William C. Geer, New Rochelle, N. Y., and Harlan L. Trumbull, Hudson, Ohio, assignors to B. F. Goodrich Company, New York, N. Y. —1,754,886.

Process of Concentrating Latex. Henry W. Banks, 3d, Noroton, Conn., assignor, by mesne assignments, to United States Rubber Company.—1,755,379.

Polymerization of Ketone-Formaldehyde Condensation Products. Charles E. Burke, Wilmington, Del., assignor to E. I. duPont de Nemours & Company, Wilmington, Del. —1,755,099.

Process for the Preparation of Condensation Products of Ethyl Alcohol. Willy O. Herrmann and Erich Baum, Munich, Germany, assignors to Consortium für Elektrochemische Industrie, Munich, Germany.—1,755,692.

Treatment of Rubber. Paul I. Murrill, Plainfield, N. J., and Walter W. Evans, New Rochelle, N. Y., assignors to R. T. Vanderbilt Co., Inc., New York.—1,755,703.

Aqueous Rubber Emulsion and Process of Producing the Same. William Beach Pratt, Wellesley, Mass., assignor, by mesne assignments, to Dispersions Process, Inc., Dover, Del.—1,755,890-2.

Process for Preparing Colored Nitrocellulose Varnishes. Erich Richter, Bitterfeld, Germany, assignor to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,756,100.

Phthalic-Urea Resin and Process of Making Same. Boris N. Lougovoy, Montclair, N. J., assignor to Ellis-Foster Company.—1,756,251-2.

Varnish or Lacquer and Method of Preparing the Same. Harold F. Wakefield, Newark, N. J., assignor to Bakelite Corporation, New York, N. Y.—1,756,267.

Process of Vulcanizing Rubber. Winfield Scott, Nitro, W. Va., assignor to The Rubber Service Laboratories Company, Akron, Ohio.—1,756,310.

Rubber Vulcanization Process. William P. ter Horst, Nitro, W. Va., assignor to The Rubber Service Laboratories Company, Akron, Ohio.—1,756,315.

Process of Recovering Volatile Plasticizers from Celluloid and the Like. Harry P. Bassett, Cynthiana, Ky.—1,756,331.

Chemical Product and Process for Making Same. Carleton Ellis and Joseph V. Meigs, Montclair, N. J., assignors, by mesne assignments, to Carleton Ellis, Montclair, N. J.—1,756,817-9.

Petroleum Refining and Products

Illuminating Oil and Process of Making Same. Frank W. Hall, Port Arthur, Tex., assignor, by mesne assignments, to Texas Company, New York, N. Y.—1,752,299.

Apparatus for the Lye Treatment of Petroleum Oils. Charles K. Parker, Richmond, Calif., assignor to Standard Oil Company of California, San Francisco, Calif.—1,752,350.

Refining System. Albert G. Peterkin, Jr., Bryn Mawr, Pa., assignor to Atlantic Refining Company, Philadelphia, Pa.,— 1,752,455.

Process of Continuously Hydrolyzing Acid Sludge, Ralph A. Halloran, Berkeley, William N. Davis, Oakland, and George A. Davidson, Berkeley, Calif., assignors to Standard Oil Company of California, San Francisco, Calif.—1,752,555.

Process for the Production of Gas and Aromatic Hydrocarbons from Heavy Hydrocarbon Oils. Alexander S. Ramage, Detroit, Mich., assignor to Ozonide Corporation.—1,752,692-3.

Process of and Apparatus for Polymerizing Oils. Stuart P. Miller, Philadelphia, Pa., assignor to Barrett Company.— 1,752,921.

Process and Apparatus for Converting Heavy Hydrocarbon Oils Into Lighter Products. Francis Sales Woidich, Sapulpa, Okla.—1,754,136.

Distillation of Hydrocarbons. Henry H. Hewetson, Elizabeth, N. J., assignor to Standard Oil Development Company, New York, N. Y.—1,753,149.

Process of Treating Fuel Oils. Albert H. Ackerman, Chicago, Ill., assignor to Catalytic Chemical Company, Denver, Colo.— 1,754,297.

Art of Cracking Hydrocarbons. Edward W. Isom, Scarsdale, N. Y., assignor to Sinclair Refining Company, New York, N. Y. —1,753,432.

Process and Apparatus for Treating Petroleum Oil. Arthur G. Bogardus, New York, N. Y., assignor to Universal Oil Products Company, Chicago, Ill.—1,753,769.

Process of Treating Oil. Carbon P. Dubbs, Wilmette, Ill., assignor to Universal Oil Products Company, Chicago, Ill.— 1,756,018-9.

Art of Continuous Distillation. Nathaniel E. Loomis, Westfield, N. J., assignor to Standard Oil Development Company.— 1,756,032.

Apparatus for Removing Carbonaceous Deposits from Oil Apparatus. Lyman C. Huff, Chicago, Ill., assignor to Universal Oil Products Company, Chicago, Ill.—1,756,027.

Manufacture of Lubricating Oils. Eugene C. Herthel, Chicago, Ill., and Harry L. Pelzer, Highland, Ind., assignors to Sinclair Refining Company, New York, N. Y.— 1,756,153-6.

Art of Cracking Hydrocarbons. Louis Link, Baton Rouge, La., assignor to Standard Oil Development Company.—1,756,563.

Oil-Cracking Process. Alfred Schwarz, Montclair, N. J., assignor to Petroleum Sand Products Corporation—1,756,887.

Coal Processing and Products

Coking Retort Oven. Joseph Becker and Joseph Van Ackeren, Pittsburgh, Pa., assignors to Koppers Company.—1,752,363.

Gas-Purification Process. David L. Jacobson, Pittsburgh, Pa., assignor to Koppers Company, Pittsburgh, Pa.—1,752,382.

Manufacture of Bituminous Emulsions. John Strother Miller, Jr., Rahway, N. J., assignor to Barber Asphalt Company, Philadelphia, Pa.—1,752,449.

Gas-Producing Apparatus. George R. Roesch, Toledo, Ohio, assignor to Tolectro Corporation, Toledo, Ohio.—1,752,851.

Coking Retort Oven. Joseph Van Ackeren, Pittsburgh, Pa., assignor to Koppers Company, Pittsburgh, Pa.—1,754,131.

Retort for the Distillation of Coal and Other Solid Carbonaceous Substances. Charles Henry Parker, Codsall, England, assignor to Low Temperature Carbonization, Ltd., London, England.—1,754,693.

Coking Coal. Samuel W. Parr and Thomas E. Layng, Urbana, Ill., assignors, by mesne assignments, to Urbana Coke Corporation, Urbana, Ill.—1,754,765.

Coking Retort Oven. Joseph Becker, Pittsburgh, Pa., assignor to Koppers Company, Pittsburgh, Pa.—1,755,381-3.

Aeration and Gas-Purification Apparatus. Gilbert E. Sell, Newark, N. J., assignor to Koppers Company, Pittsburgh, Pa.—1,755,-614.

Pitch-Coking Process and Product. Joseph Becker, Pittsburgh, Pa., assignor to Koppers Company, Pittsburgh, Pa.—1,755,-234.

Organic Processes

Method of Purifying Phenyl Ethyl Alcohol. Edgar C. Britton, Midland, Mich., assignor to The Dow Chemical Company, Midland, Mich.—1,752,365.

Process of Replacing the Water in a Water-Moist Cellulose by an Organic Liquid and the Product Thereof. Emil Hubert, Alexander Röst-Grande, and Erich Correns, Elberfeld, Germany, assignors to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,752,596.

Method of Replacing Halogen Groups in Organic Compounds by Amino Groups. Karl H. T. Pfister, Tacony, Pa., assignor to Rohm & Haas Company.—1,752,998.

Recovery of Adsorbable Substances. Arthur B. Ray, Bayside, and George T. Felbeck, Mount Vernon, N. Y., assignors to Carbide and Carbon Chemicals Corporation. —1,753,067.

Treatment of Guayule, Etc. David Spence, Norwalk, Conn., assignor to Intercontinental Rubber Company, New York, N. Y.—1,753,184-5.

Method of Producing Activated Carbon. Otto Fuchs, Constance, Germany, assignor to Holzverkohlungs-Industrie Aktiengesellschaft, Constance, Baden, Germany.—1,753,597.

Process and Means for Transforming Organic Acids Into Ketones. John W. Beckman, Oakland, Calif.—1,753,642.

Process for the Preparation of Sulphur Compounds of Pyridine. Gerd Kochendoerfer, Frankfort-on-the-Main, Germany, assignor to Deutsche Gold & Silber Scheideanstalt vormals Roessler, Frankfort-on-the-Main, Germany.—1,753,658.

Anhydrous Soap Gels and Method of Making Same. Vaman R. Kokatnur, New York, N. Y.—1,753,659.

Production of Montan Wax. Fritz Zschoch and Herbert Rodrian, Unterroblingen, Germany, assignors to A. Riebeck'sche Montanwerke Aktiengesellschaft, Halle, Saale, Germany.—1,753,816.

Method of Activating Charcoal. Georg Enssle, Constance, Germany, assignor to Holzverkohlungs - Industrie Aktiengesellschaft, Constance, Baden, Germany.—1,753,984.

Cyclic Ketones of the Aromatic Series and Process of Making Same. Fritz Mayer, Frankfort, Kurt Billig, Hochst, Karl Horst, Hofheim, and Karl Schirmacher, Hochst, Germany, assignors to I. G. Farbenindustrie Aktiengeselischaft, Frankfort, Germany.—1,754,031.

Production of Acetone. Leo Schlecht, Ludwigshafen-on-the-Rhine, Germany, assignor to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,755,193.

Synthetic-Methanol Process. Leonard A. Stengel, Terre Haute, Ind., assignor to Commercial Solvents Corporation, Terre Haute, Ind.—1,754,371.

Method of Deodorizing Fats and Fatty Oils. Herman Bollmann, Hamburg, Germany, assignor by mesne assignments, to Mary Fulford Foster, Washington, D. C.—1,754,598.

Method of Treating Casein and Product of Said Method. Philip Schidrowitz, London, England, assignor of one-half to James B. Crockett, Cambridge, Mass.—1,754,651.

Method of Chlorinating Unsaturated Hydrocarbons. Charles J. Strosacker, Midland, Mich., assignor to Dow Chemical Company, Midland, Mich.—1,754,656.

Sulphonic Acids of High Wetting Cleaning, and Emulsifying Power. Fritz Gunther, Ludwigshafen-on-the-Rhine, Germany, assignor to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,755,179.

Production of Valuable Products from Montan Wax. Wilhelm Pungs, Ludwigshafen-on-the-Rhine, and Michael Jahrstorfer, Mannheim, Germany, assignors to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,755,189.

Process of Refining Crude Phthalic Anhydride. Courtney Conover, St. Louis, Mo., assignor to Monsanto Chemical Works, St. Louis, Mo.—1,755,242.

Method of Making Sodium Salicylates. Mark E. Putnam, Milland, Mich., assignor to The Dow Chemical Company, Midland, Mich.—1,755,362.

Caustic-Soda Solution of Cellulose. Otto Leuchs, Elberfeld, Germany, assignor to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,755,657.

Manufacture of Phenates. William H. Williams and Edgar C. Britton, Midland, Mich., assignors to The Dow Chemical Company, Midland, Mich.—1,756,110.

Manufacture of Dithio Derivatives from Aldehydes. Gerald J. Leuck, Evanston, Ill., assignor to Quaker Oats Company, Chicago, Ill.—1,756,158.

Inorganic Processes

Electrolysis of Ferrous Chloride. Stanley Isaac Levy, London, England.—1,752,348.

Method of Treating Aluminous Materials. Bengt Ragnar Fritiof Kjellgren, Cleveland, Ohio.—1,752,641.

Manufacture of Chromates. Omar F. Tarr, Baltimore, Md., assignor to Mutual Chemical Company of America, New York, N. Y.—1,752,863.

Refractory Composition and Process of Making Refractory Articles Therefrom. Louis J. Trostel, Baltimore, Md., assignor to General Refractories Company, Philadelphia, Pa.—1,752,867.

Manufacture of Smokeless Powder. Charles R. Borland, Concord, Mass., assignor, by mesne assignments, to American Powder Company, Boston, Mass.—1,752,881.

Process for the Manufacture of Anhydrous Aluminum Chloride. Wray Robert Austin and James Norman Smith, Toronto, Ontario, Canada, assignors to Farley G. Clark, Toronto, Canada.—1,752,936.

Cell for Electrolyzing Solutions of Alkali Chlorides. Edouard Krebs, Oslo, Norway.—1,753,123.

Method of Recovering Alkali. Ralph H. McKee, New York, N. Y.—1,753,128.

Method for Manufacture of Di-Calcium Phosphate. Robert D. Pike, Oakland, Calif.—1,753,478.

Cement. Burr W. Tuttle, Chicago, Ill.—1,753,538.

Process of Recovering Alkali-Metal Xanthates. Wilhelm Hirschkind, Pittsburg, Calif., assignor to Great Western Electro-Chemical Company.—1,753,787.

Production of Acids. Hermann Frischer, Cologne-Lindenthal, Germany.—1,754,156.

Method of Recovering Gasifiable Metals as Oxides. Friedrich Johannsen, Magdeburg, Germany, assignor to Fried. Krupp Grusonwerk Aktiengesellschaft, Magdeburg-Buckau, Germany.—1,754,169.

Treatment of Residual Alkaline Liquors. Linn Bradley, Monclair, N. J., and Edward P. McKeefe, New York, N. Y., assignors to Bradley-McKeefe Corporation, New York, N. Y.—1,754,207-8.

Catalytic Oxidation of Ammonia. Otto Balz, Ludwigshafen-on-the-Rhine, and Fritz Reuscher, Mannheim, Germany, assignors to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,754,345.

Copies of Patents

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

Photostatic copies of foreign patents may be obtained at the same address, prices being forwarded on application.

Production of Potassium-Ammonium Sulphate. Robert Griessbach, Ludwigshafen-on-the-Rhine, and Otto Schliephake, Mannheim, Germany, assignors to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,754,358.

Method of Removing Carbon Impurities from Tantalum. Clarence W. Balke, Highland Park, Ill., assignor to Fansteel Products Company, Inc., North Chicago, Ill.—1,754,453.

Manufacture of Calcium Hypochlorite. Robert B. MacMullin and Jesse A. Guyer, La Salle, N. Y., assignors to Mathieson Alkali Works, Inc., New York, N. Y.—1,754,473-5.

Process of Producing Anhydrous Aluminum Halide from a Double Halide of Aluminum and Ammonium. Claude G. Miner, Berkeley, Calif.—1,754,797.

Continuous Sulphate Process. William D. Mount, Lynchburg, Va., assignor of one-half to Kenrick A. Forrest, Harvey, Ill.—1,754,902.

Method of Producing Artificial Marble. Johann Kneifl, Mahr. Schomberg, Czechoslovakia.—1,755,399.

Process of Preparing Siliceous Materials. Abraham Sidney Behrman, Chicago, Ill., assignor, by mesne assignments, to General Zeolite Company, Chicago, Ill.—1,755,496.

Hydraulic Cement and Other Calcareous Plastics. William Arthur Collings, Los Angeles, Calif., assignor to Silica Products Co., Los Angeles, Calif.—1,755,502.

Production of Amphoteric Hydrated Oxides of Metals by Hydrolysis. Reginald Hill Monk, Montreal, Quebec, Canada, assignor of one-half to John Irwin, Montreal, Quebec, Canada.—1,755,512.

Manufacture of Waterproof cement. John M. Evans, Berkeley, Calif., assignor of one-half to George W. Wallace, San Francisco, Calif.—1,755,638.

Process of Manufacturing Basic Calcium Hypochlorites. Saburo Urano, Takatacho, near Tokyo, and Seichiro Imai, Okucho, near Tokyo, Japan.—1,755,677.

Manufacture of Transparent Fused Pure Silica. Henri George, Paris, France, assignor to Société Quartz & Silice, Paris, France.—1,755,953.

Process for Recovering Borax from Brine. Henry D. Heilmers, Westend, Calif., assignor to West End Chemical Company, Oakland, Calif.—1,756,122.

Making Magnesium Chloride from Chlorine and a Magnesium Base. Thomas Griswold, Jr., and Ralph M. Hunter, Midland, Mich., assignors to The Dow Chemical Company, Midland, Mich.—1,756,247.

Calcined Bauxite and Method of Producing Same. Francis C. Frary, Oakmont, Pa., assignor to Aluminum Company of America, Pittsburgh, Pa.—1,756,425.

Method of Producing Phosphoric Acid and Hydrogen. Markus Larsson, Niagara Falls, N. Y., assignor, by mesne assignments, to Du Pont Ammonia Corporation, Wilmington, Del.—1,756,429.

Continuous Sulphate Process. William Cauldwell Munro, Montreal, Quebec, Canada, assignor to William D. Mount, Lynchburg, Va.—1,756,432.

Chemical Engineering Equipment

Pulverizing or Grinding Mill. David J. Uhle and Joseph V. Durnin, Allentown, Pa.—1,752,622-3.

Apparatus for Separating Solids from Liquids or Liquors by Filtration. John T. Shimmin, Hurley, N. M.—1,752,758.

Agitation and Settling Process. Charles P. Hoover, Columbus, Ohio, and Frank A. Downes, New York, N. Y.—1,752,795.

Liquid-Processing Apparatus. Edgar B. Nichols and Ulysses G. Todd, Rochester, N. Y., assignors to Pfaudler Co., Rochester, N. Y.—1,753,062.

Extractor. Alfred Partlow, Lincoln Park, Mich., assignor to Vorclone Corporation, Milwaukee, Wis.—1,753,215.

Agitation and Settling Apparatus. Frank A. Downes, New York, N. Y., assignor to Dorr Company, New York, N. Y.—1,752,789.

Hydraulic Classifier. Arthur William Fhrenwald, Moscow, Idaho, assignor to Dorr Company, New York, N. Y.—1,752,791.

Wood Preservation. Harold W. Walker, Edgewood Arsenal, Md.—1,753,000.

Process of Unhairing Hides and Skins. Harry M. Ullmann and Edwin R. Theis, Bethlehem, Pa.—1,753,539.

Air Filter. Alfred M. Goodloe, Bradford, Pa., assignor, by mesne assignments, to American Air Filter Company, Louisville, Ky.—1,753,653.

Process of Transferring Liquefied Gases From One Container to Another. Christian Wilhelm Paul Heylandt, Berlin-Lankwitz, Germany.—1,753,785.

Spray - Drying Apparatus. William Spencer Bowen, Westfield, N. J.—1,753,915.

Apparatus for Separating Liquids of Different Densities. Frank Pink, Portsmouth, England.—1,754,119.

Filtration Apparatus. Charles T. Cabrera, New York, N. Y., assignor to Electro Dialyzer Corporation, New York, N. Y.—1,754,667.

Separation of Mixtures. Laurence P. Sharples, Chester, Pa., assignor to Sharples Specialty Company, Philadelphia, Pa.—1,754,774.

Spray Drier. William O. Frohring, Shaker Heights, Ohio, and William F. Richards, Mason, Mich., assignors, by mesne assignments, to Laboratory Products Company, Cleveland, Ohio.—1,754,941.

Centrifugal Pump. Oystein Jacobsen, Dayton, Ohio, assignor to Duriron Company, Inc.—1,755,217.

Method of and Mechanism for Grinding and Separating Materials. Walter J. Clement, Utica, N. Y., assignor to Bossert Corporation, Utica, N. Y.—1,755,573.

Homogenizing Mill. William Eppenbach, College Point, N. Y., assignor to United States Colloid Mill Corporation, Long Island City, N. Y.—1,755,576.

Mixing, Dissolving, or Similar Apparatus. Henry S. Beers, Westport, Conn., assignor to Turbo-Mixer Corporation, New York, N. Y.—1,756,236.

Material for Use in Treatment of Liquids. Casimir A. Miketta, Los Angeles, Calif., assignor, by mesne assignments, to Celite Corporation, New York, N. Y.—1,756,906

NEWS *of the* INDUSTRY

World Power Conference To Be Held in Berlin

LEAVING on June 4, an American delegation of some 200 engineers and industrialists, with their families, sails for Europe aboard the "Resolute" to attend the second Plenary World Power Conference, which meets in Berlin on June 16, to remain in session on a nine-day program. With its wide range of aims and interests, it is a successor to the conference held at London in 1924, the fruition of the desire to unite the economic, executive, and engineering elements of the power field in a single sympathetic interchange of ideas. To this end, Germany's foremost engineering and administrative talent has lent its efforts and sponsorship to play host to the participating countries, numbering around 50. President von Hindenburg is official sponsor, while the responsible officers include Dr. von Miller, Dr. Köttgen and Dr. Matschoss. Among the American delegates are Ely C. Hutchinson, editor of *Power;* Scott Turner, director of U. S. Bureau of Mines; L. W. W. Morrow, editor of *Electrical World;* and H. Foster Bain, secretary of A.I.M.E.

Although the contributed papers naturally will form the core of the meetings, especial consideration has been given in the arrangements to the international origin of the guests and the unique opportunity for personal contact. As a consequence, after the participants have been officially received in the Reichstag building, they will find the sessions organized specifically to this end. The papers are divided into 34 sections, according to subject, and each under the leadership of some chairman. Since copies of all papers are available, the chairman will prepare a 15-minute abstract of his entire group, which he will present at the opening of his session. This will then leave almost two hours for general discussion, which likewise may be prepared.

A signal feature of all sessions will be the system of interpretation. The chairman, speaking in German, will be attended by two technical men interpreting in French and English, all into microphones. Meanwhile the listeners will be equipped with ear phones and a button switch, allowing them to connect at will with either of the three languages. All interpreters will necessarily be authorities versed in the technicalities and terminology of their subject.

Specifically chemical in interest will be the sessions on coal technology, gas, natural and synthetic oils, and liquid fuels. In addition, the groups on economics promise to offer stimulating material for the administrative and marketing elements of the power industries, especially in the light of present-day linkage of interdependent industries. Emphasis is further placed on general talks to be held daily by eminent authorities from various countries; among them appear the names of Albert Einstein, D. N. Dunlop, and H. Foster Bain. An article reviewing the entire conference will be sent by special correspondence from Berlin to appear in the July issue of *Chem. & Met.*

At the end of the meeting on June 25, participants may avail themselves of tours especially arranged by the committee. They will lead through various parts of Germany, terminating at different border towns, and include visits through important industrial plants, many of them, such as the I.G., ordinarily closed to visitors.

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Textile Foundation For Research

ENACTMENT of the Merritt bill to create the Textile Foundation for administering in research the $1,800,000 fund derived from the sale of German reparation dyes has been recommended to the Senate by the Judiciary Committee. The committee voted to report the bill immediately after notification on April 28 by Senator Hebert, of Rhode Island, that the bill, which passed the House on April 3, was approved by the subcommittee of which Senators Borah and Dill also are members.

The fund that would be made available for scientific and economic research in the textile industry and its allied branches, including the production and manufacture of textile raw materials, still is in the hands of the Textile Alliance, which had charge of the distribution of the reparation dyes under an agreement with the State Department. The government has brought suit for an accounting that is expected to result shortly in the entry of a consent decree discharging the Textile Alliance of its trust.

Electrochemists to Meet In St. Louis

FINAL plans for the 57th meeting of the American Electrochemical Society, which will be held in St. Louis, May 29, 30, and 31, reveal an interesting balance of scientific, technical and social features. The main session on hydroelectrometallurgy is to be in charge of T. H. Donahue, of East Chicago, Ind., and will include papers on copper, zinc, lead, cadmium, indium, bismuth, and silver. The paper on indium by L. R. Westbrook, of the Grasselli Chemical Company, promises some interesting revelations. J. J. Fingland, of the Trail smelter of the Consolidated Mining & Smelting Company, has a detailed paper on electrolytic lead.

Dr. Charles L. Mantell is to preside at the session on electrodeposition, at which papers will be presented on chromium, cadmium, nickel alloys, silver, and other plating metals. A group of miscellaneous papers will deal with such special subjects as refractories, rectifiers, dry cells, batteries, pigments, corrosion, phenol, arc and induction furnaces.

An opportunity has been afforded the members of the society to visit the new Tainton process plant of the Evans-Wallower Zinc Company, and the final day of the meeting will be given over to an excursion into the Ozark Mountains to visit the lead mines. An informal dinner and dance with special entertainment will be held at the Hotel Coronado, on May 29.

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Directors of Petroleum Institute Meet

DIRECTORS of the American Petroleum Institute at a recent meeting appointed a committee to draft a resolution commending the report made by the Committee on Petroleum Economics for the Federal Oil Conservation Board. The report gave a balance sheet on oil, with estimates of supply and demand for 1930, and on the basis of these estimates calculated that the 1930 crude-oil requirements from domestic sources would amount to 942,800,000 bbl., or 2,583,000 daily. The refining committee of the institute also met and authorized appointment of two subcommittees, one for standardization of refining equipment.

Technical Sessions for A.I.Ch.E. Meeting

RETURNING to Detroit after an absence of nine years, the American Institute of Chemical Engineers plans to make its meeting on June 4, 5 and 6, at the Book-Cadillac Hotel, one of the most interesting in its history. An unusually strong technical program centering around chemical engineering in the heavy chemical industry has been arranged by a committee in charge of Prof. W. L. Badger, of the University of Michigan. Naturally, considerable attention is to be given also to Detroit's two major industries, automobile and aviation. Several features relating to these have been arranged by the general chairman, R. A. Plumb, director of the Truscon laboratories. These will include extended inspections of the General Motors research laboratories and proving grounds, with visits to the various plants of the Ford, Cadillac, and Packard motor companies, as well as the Ford airport and aircraft factories.

Charles F. Kettering, president of the General Motors Research Corporation, is to serve as toastmaster at the banquet on Thursday, June 5. On the following day a complimentary luncheon is to be given by Parke, Davis & Company at its Detroit plant. Inspection trips have been arranged for members of the institute and their guests to visit the Canadian Salt Company, the Pennsylvania Salt Company, and the Hoskins Manufacturing Company. Programs and further information regarding the meeting are available from the office of Frederic J. Le Maistre, executive secretary, Bellevue Court Building, Philadelphia, Pa.

Plans for the technical sessions which begin Wednesday morning, June 4, include the following papers:

"Recent Advances in Causticizing," by W. E. Piper of the Dorr Company.

"Production of Oxygen From Lime and Chlorine," by O. R. Sweeney and J. W. Hussey, of Iowa State College.

"Flakeice—Its Manufacture and Use," by Crosby Field, Consulting Engineer, Brooklyn, N. Y.

"Some Experiences With the Cottrell Precipitators in the Purification of Burner Gases," by J. J. Healy, Jr., of the Merrimac Chemical Company.

In the session on Thursday morning the papers will be as follows:

"Temperature Distribution in Internally Heated Cylinders," by Prof. Albert B. Newman, of Cooper Union.

"Evaporation of Caustic Soda to High Concentrations by Means of Diphenyl Vapors," by W. L. Badger, C. C. Monrad, H. W. Diamond, of the University of Michigan.

"Film Co-efficients Between Condensing Vapors and Metal Walls," by C. C. Monrad and W. L. Badger, of the University of Michigan.

"Heat Transmission in an Experimental Inclined Tube Evaporator," by C. M. Linden and G. H. Montillon, of the University of Minnesota.

"Heat Transfer from a Gas Stream to a Bed of Broken Solids," by C. C. Furnas, of the University of Minnesota.

"Calculations of Latent Heats of Vaporization of the Normal Paraffin Hydrocarbons Using Specific Heat Data," by J. W. Shultz, of the University of Michigan.

"The Magnesium Industry," by John A. Gann of the Dow Chemical Company.

Two other papers which have been proposed but have not yet been definitely scheduled include a discussion of high purity caustic soda, by A. H. Hooker, of the Hooker Electrochemical Company, and an exposition of a new method for extrapolating experimental data, by Prof. T. R. Running, of the University of Michigan.

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Dr. Herzfeld to Lecture At Cooper Union

ANNOUNCEMENT has just been made that Dr. Karl F. Herzfeld, professor of physics in the Johns Hopkins University, will lecture at the Cooper Union, in New York City, on each Tuesday evening during the next college year. These lectures will constitute a survey of the field of modern physics and several evenings will be given to each of the following topics: crystal structure, absorption and emission of light in the quantum theory, photochemistry, dielectric polarization and the structure of molecules, outline of atomic structure, band spectra and the structure of gas molecules.

The lectures have been arranged by the departments of chemical engineering and physics at the Cooper Union, and will be open without the payment of fees to interested persons who have had the necessary mathematical preparation. Dr. Herzfeld's lectures form part of a program of advanced courses being offered at Cooper Union for the benefit of those industrial scientists and engineers who desire to keep abreast of the newest developments affecting their fields of work.

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Petroleum Refining At M.I.T.

SPECIAL courses in petroleum refining will be given in the summer session of the Massachusetts Institute of Technology, from July 7 to Aug. 9. One course on dynamics of fluids and flow of heat will be conducted by Dr. T. K. Sherwood and one on distillation, rectification, and absorption will be directed by Dr. W. K. Lewis. The work is planned primarily to meet the needs of technical men in the petroleum industry, particularly young men, who, though possessing a sound engineering and chemical background, lack specialized training in the fundamentals of fluid dynamics, flow of heat, and the mechanism of interaction of phases. Registration for the work will be limited to men with adequate training along engineering and chemical lines, who have also had industrial experience in petroleum refining, or in other industries in which the design or operation of heat-transmission equipment, stills, rectifying columns, etc., is of importance.

New York Paint Club Elects Officers

AT A meeting of the Paint, Oil, and Varnish Club of New York, held May 8 at the Hotel New Yorker, Harold Rowe, assistant manager of the Atlantic branch of the National Lead Company, was elected president of the club. Other officers elected were: vice-president J. W. Robson, of the Standard Varnish Works; secretary, R. W. Hafner, of Toch Brothers, Inc.; treasurer, H. E. Hendrickson, of S. Winterbourne & Company; members of the executive committee, R. M. Roosevelt, of the Eagle-Picher Lead Company, chairman; I. L. Darling, of France, Campbell & Darling, Inc.; Rolland H. French, of the Commercial Solvents Corporation; Charles F. Guignon; Dean C. Anderson, of the Brooklyn Varnish Manufacturing Company, and David H. Litter, of the D. H. Litter Company; members of the arbitration committee, G. W. Fortmeyer, honorary chairman; H. S. Chatfield, of the MacLac-Kasebier-Chatfield Corporation, chairman; Henry L. Calman, of Emil Calman & Company; Harry J. Schnell, of the *Oil, Paint and Drug Reporter;* William R. Morpeth, of the Grasselli Chemical Company, and Randall O. Walker, of the Thibaut & Walker Company.

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Revision of Patent Office Rules

THE Cramton bill revising Patent Office rules of practice for the purpose of preventing deception of inventors by unauthorized attorneys was favorably reported to the Senate on May 7. The bill passed the House, March 18. The bill declares it to be unlawful for any person to hold himself out as a patent attorney or patent agent unless he has been admitted to practice before the Patent Office. Persons admitted to practice in the future may not represent themselves as patent attorneys, patent lawyers, patent solicitors, or patent counselors unless they have been legally admitted to the practice of law. Engineers, chemists, and other scientific and technical experts will be recognized to practice before the Patent Office as patent agents.

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Federal Specifications In New Form

GOVERNMENT specifications take on new form with the creation of the Federal Standard Stock Catalog. Hereafter, all specifications covering government purchases will be handled through this agency and copies of the specifications which are desired by industries either manufacturing or purchasing these commodities will have to be procured by buying the leaflets from the Superintendent of Documents, Government Printing Office, Washington, D. C. There will no longer be any free distribution whatsoever of specifications.

NEWS FROM WASHINGTON

By Paul Wooton

Washington Correspondent of Chem. & Met.

REVISION of the tariff has been a relatively quiet process during the past month, pending the last bitter fight which is just ahead. Nothing has happened to indicate any change in the chemical rates beyond the tabulation in the April issue of *Chem. & Met.*, which probably will stand as a conversion table between existing rates and the new law. After the conference committee had gone through the bill in record time, adjusting the differences between the House and Senate versions of what a tariff should be, a partial report was accepted by the House. The base rate on Cuban sugar, one of the most contested items, was definitely fixed at 2c. per 100 lb. Casein went through in the conference report at 5½c. per pound. Cement was put at 6c. per 100 lb., but it is still to be decided whether imports for state and municipal purposes shall be duty free. Five other Senate provisions were rejected by the House: the silver duty of 30c. per ounce; the softwood lumber duty of $1 per M ft. b.m.; the debenture; the vesting of tariff flexibility in Congress; and coincident differences in the Tariff Commission.

When the bill went back to the Senate, it was returned immediately to conference, with no yielding on any of these points. Moreover, the Senate failed to accept the conference report, thus leaving the entire tariff rate structure in the air. Although a majority probably would favor passing the report as it stands, such action would drag down the important administrative changes to certain defeat. The strategy on the part of those who wish to force Congress into accepting the debenture and the other new and strange provisions is to hold the commodity schedules as a powerful means of persuasion. They will attempt to say, "No debenture, no bill." The president is expected to veto the bill if the debenture is thrown in as a rider. All these complexities aside, it still looks as if some sort of bill can be put through before the end of June with the rate structure at the conference level.

CHEMICALS have fared well in the readjustment. Under the 1922 act, now in force, the average rate for the chemical schedule is 28.92 per cent ad valorem. The conference rate, accepted by the House and facing no Senate difficulties on its own account, is 31.07 per cent. Few significant reductions have been made in any chemical items and the general level has been advanced more than 2 per cent ad valorem, or 7 per cent in the amount of duties collected. About half of the advance is due to compensatory duties and straight increases on agricultural commodities entering the schedule. This is in accordance with the general idea that the tariff is to help agriculture as much as possible. Still, the rewritten schedule is expected to be of particular help to numerous branches of the chemical industry facing serious import competition.

ADMINISTRATION leaders have been making courageous efforts to produce a new and better Muscle Shoals bill, but the outlook still is against a settlement this session of Congress unless a very adroitly staged political miracle intervenes. After the Norris resolution passed the Senate it was first thought that the House Military Affairs Committee would make amendments to emasculate the government ownership provisions. The committee members went further than that by striking out the Norris plan altogether. They then drafted and submitted to the House a new bill for leasing the properties. Passage by the House is expected. The bill can then go directly to conference between the two chambers of Congress, but it is hardly expected that a compromise can be reached before the end of this session.

Technically, the new bill is viewed as a good one. It kills the government ownership scheme by providing private leasing. It disqualifies power companies as bidders, thus removing the "power trust" issue. It permits the President to go ahead and get rid of the Shoals without further Congressional action.

In more detail, what the bill does is to empower the President to appoint without confirmation a board of three eminent citizens, one of whom is identified with agriculture. The board is to appraise the property and then to lease it on the best terms possible for fertilizer, ferro-alloy, and other electrochemical production. The lessee or lessees shall make fertilizer containing not less than 10,000 tons of fixed nitrogen within the first three years and shall maintain production above a prescribed amount thereafter. Fertilizer is to be sold on the open market, farmers and co-operatives preferred, at cost plus a profit not over 8 per cent on the turnover produced and not over 6 per cent on capital investments made by the company for improvements or additions to existing plants. The profits from the power sales due to suspension of fertilizer production and half the profits due to power savings from increased production efficiency shall be credited to production cost.

Excess power is to be allocated within economic range, political subdivisions preferred. Lessees are to construct Cove Creek Dam and Dam No. 3 under the Water Power Act, partly reimbursed by federal funds for the navigation features involved and by royalties from benefits to downstream plants. Tennessee can recapture Cove Creek Dam. The federal government gets a fair rental and annual payments which compounded at 4 per cent over 50 years will amortize the appraised value. Government can recapture temporarily for national defense or permanently in case of breach of contract.

WHETHER the new law placing enforcement of the National Prohibition Act in the Department of Justice will disrupt the permissive system under which the requirements of legitimate industry for alcohol are met will depend to a large extent upon the department's attitude. Despite the protest of the alcohol-using trades, the Williamson bill was reported to the Senate on May 5 with none of the safeguards which would prevent undue interference by the Department of Justice in the administration of the permissive system by the Treasury Department.

These recommendations will be renewed by Senator Tydings, of Maryland, in the form of amendments to the bill on the floor, but it is doubtful whether this last desperate effort to eliminate dual control over the issuance and renewal of withdrawal permits will be successful. The bill has been given a preferred position on the Senate's legislative program as mapped out by the steering committee for the remainder of the session.

Enactment of the measure in substantially its present form is regarded as certain. The administration forces recognize only that this is one of the measures desired by President Hoover in his program for law enforcement and few of them are interested in the harassing details of the bill. For this reason, if no other, the amendments proposed by Senator Tydings are not likely to prevail when the bill is brought up for passage.

These amendments are not directed against the authority vested in the Attorney General to prescribe jointly with the Secretary of the Treasury the permit regulations but against provisions whereby the Attorney General also may act jointly with the Secretary of the Treasury in passing upon applications for permits which, in such cases, shall not be granted without their joint approval. The amendments also are directed against the provision under which no permit issued for more than 90 days shall be granted, renewed, or amended until 10 days after copy of the application has been filed with the Attorney General by the Secretary of the Treasury. To avoid this delay the amendments provide that upon receipt of any application the Attorney General shall forthwith notify the Secretary of the Treasury whether he desires to intervene in the proceedings. The Attorney General also would be permitted to intervene after a permit has been issued if he has information that the permittee is violating the prohibition act.

British Development Company Under Government Auspices

Will Provide Funds for Rationalization of Basic Industries

From Our London Correspondent

THE BOGEY of the budget, which had been made the excuse for nearly every shortcoming in trade and industry, has now been laid, and one can see in truer perspective the extent to which it was attempted to use its uncertainties in promoting sectional interests by political pressure. Actually, the state of trade, and particularly that of the chemical industry, is by no means discouraging, and with cheap money and the prospective fall in the cost of living, the competitive power of British industries is likely to increase materially.

Soundly and conservatively managed enterprises such as Imperial Chemical Industries, Pinchin Johnson & Company, Levers, Powell Duffryn, Babcock & Wilcox, and the Salt Union, to take a few at random, show steady progress, while many companies of recent and mushroom growth formed of the speculative boom are gradually being eliminated; among the latter, lack of technical knowledge or guidance before and after commencing business has often been the cause of failure.

The rayon industry has been given at least a year's respite as regards import duties, and this should enable the fittest of the smaller concerns to survive.

British Celanese reports increased turnover and should now succeed in consolidating its position and showing at least some return to the long-suffering shareholders.

Transparent paper (cellophane type) both of the viscose and acetate varieties will shortly be produced in this country, the many technical and manufacturing difficulties having been patiently surmounted. The uses and possibilities of this convenient wrapping paper are being increasingly appreciated and among others the idea of wrapping fish fillets and Australian meat packages before chilling is being considered. The waterproofing of the viscose paper and the elimination of the solvent smell from the acetate paper also appear to be in sight.

THE creation under government auspices of the Bankers Industrial Development Company is of outstanding interest and importance, the object being to receive schemes for the rationalization of basic industries and to provide the necessary money to carry them out. An advisory committee will assist the limited number of banking and financial institutions which are subscribing for the "A" shares, while the "B" shares are to be held by the Securities Management Trust, of which G. Bruce Gardner has been appointed managing director. Mr. Gardner was formerly managing director of the Shelton Iron & Steel Company, and among his colleagues on the board of this development company may be mentioned the chairman, Mr. Norman, governor of the Bank of England; Sir Guy Granet, and Baron Schröder. Although the heavy chemical industry may be already regarded as partly rationalized, there are many chemical operations ancillary to and vital for the success of other basic industries that may usefully fall within the purview of this organization. The directors are to serve without remuneration, no state guarantees are involved, and banking capital is to be utilized, so evidently there will be plenty of room for others in the more speculative fields.

Another paternal state gesture is the creation of the Overseas Trade Development Council to assist the corresponding Department of the Board of Trade, presumably on lines similar to those current in the U. S. Department of Commerce. Representatives of trade and industry are to assist in an advisory capacity, and the names of J. G. Nicholson, a director of I.C.I., and Sir William Larke, of the National Federation of Iron & Steel Manufacturers, are of interest in this connection.

THE German Nitrogen Syndicate agreement has been renewed and the Ruhr producers have at last come into the fold. As a result, quotas have been fixed for Imperial Chemical Industries as well as the I.G. and other producers, and as the French and Belgians may also come in, we appear to be in sight of more stable and promising market and price conditions than recently seemed possible since the large Billingham output descended on a market faced with temporary overproduction. Fortunately, the nitrogen market may escape the difficulties of the European coal situation, which is again threatened by cheap export coal from Poland and Upper Silesia. The new line of attack comes from the modern coal-handling facilities at Gdynia combined with special coal trains with 50-ton self-discharging wagons. It is reported that on this long haul a freight rate of less than one dollar per ton can be secured. and with coal produced at $1.50 net at the mine, the danger is obvious.

The report of the Chemical & Metallurgical Corporation discloses an unfortunate position, inasmuch as its metallurgical processes have definitely failed and been abandoned. Unfortunate differences also have arisen leading to the dismissal of one of the managing directors, Stanley C. Smith, whose report was rejected by the casting vote of A. W. Hahn, the metallurgist from Salt Lake City, who was called in to make an independent report.

The company's chemical plant is one of the most modern and efficient in the country, but in some directions, notably hydrochloric acid, a serious price war, leading recently to stabilization by agreement, added to the existing difficulties. The company has a large Grillo contact sulphuric-acid plant and a modern ammonium sulphate plant, purchasing gas liquor locally, and it seems probable that after reorganization of capital and readjustment of outlook, a reasonably profitable future may be expected.

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Seven Southeastern States Form Regional Council

SEVEN states of the Southeast are to hold an annual economic conference beginning this fall and set up a regional council to co-ordinate the development of this economic area. This decision was reached at the conference of governors held April 28, at Asheville, N. C. The organization will be patterned after the New England Council and follow the general program of purposes outlined in *The Business Week* in a series of articles last fall which urged that other sections of the country capitalize the experience of New England.

Governor Gardner of North Carolina called the meeting and presided. Governor Horton of Tennessee and Governor Carlton of Florida were present in person and the governors of Virginia, South Carolina, Georgia, and Alabama sent representatives. From each state came delegates selected from the leaders of business, industry, and finance. Frank Page, the man who carried through North Carolina's celebrated road-building program, was appointed temporary chairman to go forward with the project and bring together the first Southeastern Economic Conference in October, at which it is planned to set up the Southeastern Regional Council as the working organization. This annual conference, if it follows the New England plan, would consist of delegates from all the agricultural, business and industrial organizations of the area, who would elect twelve councilors from each state, representative of agriculture, commerce, industry, and finance.

These men would form the council and organize in committees to study the problems of the Southeast and to promote its development. Since each state would have a man on each committee, group thought and group action would be insured.

The Asheville conference was unanimous in its indorsement of the idea, believing that the time is right for practical co-operation between the Southeastern states and the solution of their coming problems. It was recognized that the interests of these several states are increasingly influenced by economic factors that know no political boundaries and that progress is more and more dependent upon the development of resources that are regional.

French Chemical Manufacturers Find Good Outlets in Home Markets

Taxation and High Transportation Rates Slow Up Export Trade

From Our Paris Correspondent

THE POSITION of the French chemical industry is satisfactory, in the home market at least. Prices of sulphuric acid are rising steadily, thus showing that the demand exceeds the supply, and soda ash and caustic soda also are tending upward in value. Export sales are difficult both in the chemical and the metallurgical trades, and France's balance sheet shows a strong deficit, but it is hoped this situation will change if the promised reductions of taxes on commercial transactions, transportation rates, and other fiscal duties are made.

Agricultural circles are uneasy, as the splendid wheat crop and exceedingly good vintage of 1929 have brought down prices tremendously; agriculturists therefore buy less fertilizers and that special branch of the chemical trade has slackened accordingly. The wool trade also has become less active, prices of raw wool having dropped to pre-war prices and even lower, manufactured woolen goods following suit, and prices and sales falling considerably.

The rayon industry is undoubtedly uneasy; the situation may even be said to be serious. Though prices of rayon have fallen approximately by 25 per cent in the last eighteen months the "Comptoir des Textiles," which groups all important French producers, has announced another decline in prices. It is believed this measure was taken to compel new and small rayon works to close down or stop producing.

ACCURATE figures cannot be quoted regarding the French output of rayon, as this product is produced by about 45 firms of different importance and it is almost impossible to ascertain definitely each firm's output. According to the Lyonnese Silk Manufacturers' Syndicate the present rate of output would show about 19,000 tons for 1929, against 18,000 tons in 1928. About 85 per cent of the French rayon produced is viscose rayon, acetate rayon representing only 10 per cent of the total. The Roanne works will extend and another factory will be built at Chauny. The last-named works will use the Kuttner process.

As French rayon exports reached 5,400 tons in 1929, pessimistic observers state that the French rayon industry's output exceeds the demand. It should be noted, however, that even on the home market a greater consumption of rayon is possible, as France consumes only 300 grammes per inhabitant, whereas in the United States, for instance, the consumption per inhabitant is nearly double that.

In fact, all textile districts of eastern France now consume rayon and weave mixed textile fabrics, whereas a few years ago these kinds of tissues could be found only in the Lyons silk districts. Nevertheless, the French rayon trade is uneasy and this situation may either be the result of an unsatisfactory organization of the silk and rayon market, or the outcome of the keen competition among rayon manufacturers, French and foreign, in the home and foreign markets.

The present situation may be judged by the financial results quoted: In 1929 the net profits of the Tubize Rayon Company (whose main works are in Belgium) were 9,500,000 francs; in 1928 the same firm realized a net profit of 35,500,000 francs. No dividends were given to shareholders in 1929.

The Tubize Rayon Company no longer produces collodion rayon, as the collodion process competes unfavorably with the viscose rayon process. Viscose rayon will therefore be made more and more extensively and the present daily output of 4,500 kilos will become 8,500 kilos shortly. The same firm also produces acetate rayon under the name of setilose, the daily output of setilose being 2,500 kilos. The French branch of the Tubize Rayon Company also has seen its profits drop in 1929; in 1928 these profits were 20,500,000 francs; in 1929, 5,500,000 francs. On the other hand, the Venissieux works are now enlarged and their output has doubled. Another Tubize factory is being built at Corsico, in Italy, and will start producing next July.

AMONG the most important acetate rayon manufacturers, the Rhodiaseta Company should be especially mentioned. This company is a branch of the Société des Usines Chimique du Rhône, which amalgamated with the Poulenc Company, its former competitor, under the name of the Rhône-Poulenc Company. This new firm controls practically the whole French market of pharmaceutical and laboratory products and laboratory apparatus.

In the rayon industry the Rhodiaseta's position is very strong, though the company's capital does not exceed 15,000,000 francs. In fact the Rhodiaseta's working capital is far more important, as it is the Rhône-Poulenc Company itself, which has built or financed the Rhodiaseta's works of Lyons-Vaise and Roussillon. It also supports the Rhodiaseta's credit and grants all licenses of the Rhodiaseta's rayon processes in all foreign countries; so far in the United States, Germany, Switzerland, and Brazil. Up to now all profits made by the Rhodiaseta have been considered as sinking fund and reserve money, but it is believed that the Rhodiaseta Company will shortly give its shareholders dividends.

Other rayon companies, especially the new or smaller ones, are in an almost precarious position and in most cases the manufacture of artificial wool made out of specially produced viscose has almost stopped. We had mentioned this artificial wool or Pellerin process in a previous letter. Some time ago the powerful St. Gobain Company, France's oldest and richest glass and chemical products manufacturer, was believed to be interested in the Pellerin process, but according to latest rumors the company seems to have changed its objective. It is interested in a new process for refining petroleum oils and strongly supports (and controls) the new Raffineries de Berre, which have been specially built on the Berre lake (near Marseilles) for the refining of petroleum oils by this new process.

By utilizing the byproducts of refined petroleum oils, the St. Gobain Company would also manufacture synthetic products, a new branch of its activity, as up to now the St. Gobain's chemical products were essentially mineral products and not organic chemistry products.

Newport Company In Merger

FORMATION of a new company, under a plan for the consolidation of the dyestuffs and chemical division of the Newport Company with the International Printing Ink Corporation was announced at the beginning of the month. The consolidated company will have assets exceeding $25,000,000 and an authorized capitalization consisting of 350,000 shares of cumulative preferred stock ($100 par value) and 2,000,000 shares of common stock without par value.

The International Printing Ink Corporation has outstanding $7,000,000 of $10,000,000 authorized amount of the 6 per cent preferred stock and 270,173 shares of 400,000 shares authorized of no par value common stock.

Terms of the proposed consolidation call for the acquisition by the new corporation of all or the major part of the outstanding securities of the International Printing Ink Corporation and all the stock of the Newport Chemical Corporation, which is to be formed under Delaware laws to acquire all of the business and assets of the dyestuffs and chemical division of the Newport Company. The latter will continue in existence, retaining its wood distillate division.

It is believed that A. A. Schlesinger, now president of the Newport Company, will head the consolidated company as chairman of the board of directors, and John M. Tuttle, now president of the International Printing Ink Corporation, will become president of the new company.

U. S. Chamber of Commerce Annual Meeting

TWENTY-FIVE hundred of the nation's business leaders assembled in Washington April 29, for the eighteenth annual meeting of the Chamber of Commerce of the United States. The general meeting was preceded on April 28 by the annual meeting of the National Councilors.

The problems which confront business were outlined by President Butterworth in his opening address. Conspicuous among these were taxation, trade regulation, and industrial expansion. But the dominant note sounded by him was the responsibility of business in maintaining orderly progress with a minimum of the fluctuation which results in unemployment and dislocation.

"What's Ahead for Business" formed the keynote of the meeting and throughout the three-day session round-table discussions touched upon conditions—past, present, and future—which have a bearing upon industry in its different general subdivisions. Banking, construction, exporting, waterways, natural resources, insurance, railroads, retailing, taxation, and trade practices, all were discussed and dissected with a view of defining and offering solutions for the major problems ahead of industry.

At the annual dinner, held on the evening of May 1, President Hoover was the sole speaker. The President touched upon the effort which trade leaders had made to check the business slump which started last fall and proposed another momentous step in economic stabilization by announcing his purpose to organize a body, representative of business, economics, agriculture, and labor, to serve the purpose of a national economic council.

Resolutions covering a wide range of subjects and dealing with important phases of national economic policy were adopted at the concluding session.

Among the resolutions adopted was one which read that "adequate provision for the administration of the patent system is an important factor in the industrial progress of the country. Congress has recently enabled the Patent Office to increase its staff. We urge that the Patent Office should at all times in its staff and through the compensation it pays for efficient services be in a position to perform its functions with that promptness and that accuracy which are essential for the welfare of American business enterprises."

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Spontaneous Ignition Under Study

TO REPRESENT the Department of Agriculture David J. Price, Harry E. Roethe, and Dr. Lawrence H. James, of the Bureau of Chemistry and Soils, have been named by Secretary Hyde on a national committee to study spontaneous heating and ignition of agricultural products. The committee will meet in Atlantic City, May 13, to formulate plans for and to correlate the various parts of a national research program for dealing with this subject.

The committee will include representatives of the Bureau of Mines and of the Bureau of Standards in the Department of Commerce, and representatives of the fertilizer industry, the paint and varnish manufacturers, the feed manufacturers, railroads and steamship companies, insurance companies, and other industries which handle stored products.

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New Cottonseed Oil Trading Contract

Trading in cottonseed oil under new rules adopted by the board of managers of the New York Produce Exchange began on May 8, according to resolutions of the board which provide that such trade at the outset may be for delivery in any month from November, 1930, to April, 1931. Transactions, in accordance with the old rules, may be made up to and including December, 1930, but such transactions will not be permitted to provide for delivery beyond December, 1930. The new rules provide that a contract shall be for 60,000 lb. of loose oil and give a description of the contract grade.

New Silicate Plant For California

ACCORDING to a report from the Chamber of Commerce at South Gate, Cal., the Philadelphia Quartz Company of California has purchased 12½ acres of land at South Gate, on which it will erect a $500,000 plant. The Philadelphia Quartz Company of California is a branch of the Philadelphia company. The new plant will be used chiefly for the manufacture of silicate of soda. The company plans to supply its Southern California and Mexican trade with shipments from the South Gate plant. Present business in that locality is said to have been the determining factor in the decision to erect a plant there.

Imperial Chemical Issues Report

(From Our London Correspondent)

THE annual report of Imperial Chemical Industries, Ltd., for 1929 refers to the financial regrouping of the constituent companies which has been in progress for some time on the basis of manufacture of similar products. At the time of writing, important negotiations are proceeding in Paris with the I.G. and the Chile nitrate producers. It is also reported that with an initial credit of 15 million dollars I.C.I. has concluded a trading and technical agreement with Russia, relating to fertilizers and dyestuffs. The projected synthetic ammonia plant in South Africa will, as anticipated, be devoted in the first instance mainly to the nitric-acid requirements of the local chemical and explosives industry. The balance sheet is an impressive and satisfactory document disclosing net earnings of 28 million dollars, or 2½ million more than in the previous year. The reserves show an increase from 50 to 80 million dollars, chiefly on account of share premiums received on increase in capital of 50 million dollars.

The Rio Tinto Company has for some time been preparing for the threat of sulphur to the pyrites market and announces its interest in producing at an early date sulphur by the splitting of inferior grades of pyrites into its constituent elements.

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Gas Engineering Course At Illinois

THE University of Illinois, in cooperation with the Illinois Gas Association, will hold its fifth annual short course June 16 to June 28. The curriculum covers eight hours a day of practical modern gas engineering presented in an understandable way by professors of national reputation and leading authorities in gas and allied industries.

Dr. D. B. Keyes, professor of industrial chemistry and an authority on research, will conduct the course this year. Applications for enrollment may be had by writing to George Schwaner, secretary, Illinois Gas Association, 405 Mine Workers Building, Springfield, Ill.

CALENDAR OF FORTHCOMING EVENTS

AMERICAN ELECTROCHEMICAL SOCIETY, spring meeting, St. Louis, May 29-31.

AMERICAN SOCIETY FOR TESTING MATERIALS, annual meeting, Atlantic City, June 23-27.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, spring meeting, Detroit, June 4-6.

AMERICAN REFRACTORIES INSTITUTE, annual meeting, White Sulphur Springs, W. Va., May 19-20.

AMERICAN CHEMICAL SOCIETY, 80th meeting, Cincinnati, Sept. 8-12.

EXPOSITION FOR CHEMICAL APPARATUS (Achema), Frankfort, Germany, June 10-22.

INTERNATIONAL EXPOSITION AT LIÉGE, Belgium, chemical and engineering sessions, Sept. 14-21.

NATIONAL METAL CONGRESS, 12th annual meeting, Chicago, Sept. 22-26.

SECOND PLENARY WORLD POWER CONFERENCE, Berlin, Germany, June 16-25.

MEN IN CHEMICAL ENGINEERING

IRVING LANGMUIR, associate director of research of the General Electric Company, will be recipient of the Willard Gibbs Medal of the Chicago section of the American Chemical Society. Julius Stieglitz will make the presentation on May 23 at a distinguished gathering which will take part in a reception and dinner before the ceremony.

FRANK VILBRANDT, for nine years with the University of North Carolina, has resigned to become professor of chemical engineering and director of research at Iowa State University. Dr. Vilbrandt became professor of industrial chemistry at North Carolina in 1921 and in 1927 was appointed head of the department of chemical engineering.

RALPH A. SHERMAN has joined the Battelle Memorial Institute to direct the research on combustion. For the past 10 years Mr. Sherman has been fuel engineer with the Pittsburgh Experiment Station of the U. S. Bureau of Mines.

J. B. WIESEL has been appointed by the Hercules Powder Company to direct the sales and development of its cellulose products department.

GUSTAV EGLOFF, of the Universal Oil Products Company, is sailing with Mrs. Egloff on June 4 to attend the World Power Conference at Berlin.

ARTHUR W. HIXON, of the department of chemical engineering at Columbia University, is among the American visitors sailing on June 4 to the World Power Conference at Berlin.

J. G. DAVIDSON has been promoted to general sales manager of the Carbide & Carbon Chemicals Corporation, New York.

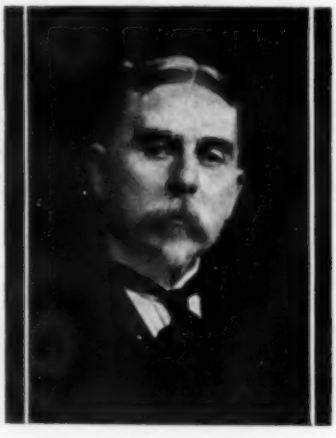
GEORGE GRANGER BROWN has been appointed professor of chemical engineering at the University of Michigan. His association there dates back to 1920, when he terminated several years' industrial experience to become an instructor.

FREDERICK S. BACON has joined the Boston Blacking Company, the chemical division of the United Shoe Machinery Company, Boston, to engage in research and development.

T. R. HARNEY, who for some time has been superintendent of the acid division of the Monsanto Chemical Works, Monsanto, Ill., has recently been transferred to the St. Louis office to take charge of acid plant engineering.

EUGENE C. SULLIVAN, president of the Corning Glass Works, Corning, N. Y., has tendered his resignation from that post and was elected vice-chairman of the board. Dr. Sullivan, who was president since 1928, will continue to be active in the affairs of the company, particularly in research and development.

D. MCINTOSH, who was head of the department of chemistry at Dalhousie University, has accepted the position as chief of research for Shawinigan Chemicals, Ltd. Dr. McIntosh received his education in Canada and the United States and has devoted most of his career to teaching, especially along electrochemical lines.



CHARLES FRANCIS MCKENNA

F. W. SKIRROW, since 1919 in charge of research for Shawinigan Chemicals, Ltd., at Shawinigan Falls, Canada, will henceforth fill the new post of technical representative in London for his company. Dr. Skirrow's career includes a long experience in Europe as well as many years of teaching in the universities of Canada and the United States.

CLAIRE UPTHEGROVE, has been promoted from associate professor to professor of metallurgical engineering at the University of Michigan.

E. S. STATELER has joined the staff of *Food Industries* as assistant editor. Since graduating from the University of Kansas, he has covered a rather wide range of industrial experience, with emphasis on food technology. After being food analyst for the State of Kansas he was plant supervisor in the dye works of the duPont Company, and in 1920 became industrial research fellow at Mellon Institute. In 1923 he joined the Eatmor Chocolate Company, where he was plant superintendent until this year.

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OBITUARY

BRAINERD F. PHILLIPSON, president of the Climax Molybdenum Company, died after a brief illness in his New York home on April 7. He was graduated from Columbia University in 1913 and headed his company from the time of its formation in 1918. Mr. Phillipson was born in Chicago 40 years ago.

ALLERTON S. CUSHMAN, best known as the founder and original director of the Institute of Industrial Research, Washington, D. C., died in New York City on May 1, at the age of 62. Because of the widely varied character of the contacts and activities of Dr. Cushman he had acquaintances and friends in many branches of industry, especially in those industries where he was so largely instrumental in creating an appreciation of the importance and value of industrial research.

CHARLES FRANCIS MCKENNA, who retired from chemical engineering when an illness forced him to abandon active work eight years ago, died on April 26 at his home in New York. Dr. McKenna, a native of New York, was 68 years old and made the metropolitan district the principal scene of his life. He attended St. Francis Xavier College and received degrees at Columbia University, whereupon he was associated with the Laboratory of Physical Testing of New York, finally as director. From 1897 until his retirement he maintained a consulting practice and devoted much energy to institutional activities. Thus, he was president of the American Institute of Chemical Engineers in 1910, president of the Chemists Club in 1914, and chairman of the sub-committee on chemical engineering for the Council of National Defense in 1918.

ERNEST WATZL, consulting chemical engineer resident in Cleveland, died as a suicide in Vienna, Austria, in March, according to posthumous letters received from him and his consort, a young Cleveland woman who also took her life. Dr. Watzl, a native of Vienna 41 years ago, went through a rigorous technical training on the Continent, served four years in the War, and successfully built numerous chemical plants in Europe before becoming established in Cleveland in 1925. Prior to his independent practice there, he was retained by the City of Cleveland, and the Grasselli Chemical Company as consultant.

MARTIN H. SMITH, manufacturing chemist and president of the company bearing his name, died at his country home near Annapolis, Md., on April 8.

HENRY L. HOTCHKISS, director of the U. S. Rubber Company and former president of the L. Candee Rubber Company, died at Derby, Conn., while watching the annual boat races there. Mr. Hotchkiss, a graduate of Yale, was 87 years old.

MARKET APPRAISAL OF CHEMICAL INDUSTRY

NET INCOME of the American I. G. Chemical Corporation for its first fiscal year—11 months ended March 31, 1930—amounted to $2,088,442.37. The company was organized April 26, 1929. Total income for the period amounted to $3,786,562.55 from which were deducted general and administrative expenses and taxes amounting to $229,790.83 and interest on debentures amounting to $1,468,329.35. The company's balance sheet shows total assets amounted to $65,805,622.56, of which $43,574,886.50 represented investments.

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Net earnings of the Newport Company for the first quarter were $426,017, after depreciation reserves and taxes, an increase of $70,087, or 19.7 per cent, over first quarter of 1929.

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A report from London states that Imperial Chemical Industries, Ltd., has arranged to extend credit to Russia. The credit is to cover a two-year period and to apply on purchases of chemicals, dyes, and fertilizers by the Soviet government from Imperial Chemical Industries, Ltd. The extent of the credit is reported at £3,000,000.

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Net loss of Anglo-Chilean Consolidated Nitrate Corporation and subsidiaries for six months ended Dec. 31, 1929, was $1,299,311 after taxes, interest, depreciation, depletion, etc., comparing with net loss of $1,828,756 in corresponding six months of 1928.

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Net profits of Montecatini, the leading Italian producer of chemicals, for 1929 were 98,172,000 lire, or 5,817,000 less than for 1928, after 11,125,000 was set aside for depreciation, but dividend is maintained at 18 per cent.

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On May 20, stockholders of Libby-Owens Glass Company will meet to approve merger of the company with the Edward Ford Plate Glass Company. The new company will be called Libby-Owens-Ford Glass Company.

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Temporary receivers have been appointed for the Standard Plate Glass Company. Fixed assets are estimated at $3,750,000, quick assets at $450,000, and liabilities at $175,000. There is also $750,000 due on notes for a bond issue of 1925.

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Financial statements for the first quarter of this year of companies in the chemical and allied industries generally report smaller net incomes than those earned in the first quarter of 1929. Reports available give the following comparisons:

Net Income, First Quarter, 1929–1930

	1930	1929
Air Reduction	$1,523,276	$1,237,562
Am. Commercial Alcohol	175,349	290,449
American Zinc	226,332	314,908
American Maize Products	401,918	552,020
American Metal	773,372	766,471
Atlas Powder	350,697	523,089
Certain-teed Products	*550,564	*583,575
Commercial Solvents	750,492	844,355
Corn Products	3,152,343	3,435,404
Du Pont	17,347,626	25,005,094
Hercules Powder	731,535	939,046
Industrial Rayon	359,439	379,828
Libby-Owens Glass	716,773	582,746
Mathieson Alkali	541,946	506,674
Monsanto Chemical	293,170	.....
Nat'l Distillers Products	204,496	232,279
Skelly Oil	547,510	1,170,208
Texas Gulf Sulphur	3,803,701	3,880,260
Union Carbide	6,472,783	7,203,946
U. S. Leather	176,328	*843,674
Westvaco Chlorine	239,762	301,941

*Net loss.

Price Range 1930 High	Price Range 1930 Low	Stock	Price Range in April: April 1	April High	April Low	April 30
34	19	Agfa Ansco Corp	22	34	22	31
150⅛	118	Air Reduction	140⅛	150⅛	138⅛	144⅛
2½	1⅛	Ajax Rubber	2⅛	2½	1⅛	2
343	255½	Allied Chemical	298	343	296	325
356	275	Aluminum Co	337	356	335	....
10⅛	6⅛	Am. Ag. Chemical	9⅛	9⅛	7	7
33	19	Am. Commercial Alcohol	23⅛	26	19	20⅛
37	25⅛	American Cyanamid, B	33⅛	35⅛	28⅛	30⅛
7	4⅛	American Hide & Leather	....	7	4⅛	....
51⅛	41	American Metals	48⅛	51⅛	41	42
79⅛	68⅛	Am. Smelting & Refining	77⅛	79⅛	68⅛	68⅛
22⅛	10	Am. Solvents & Chemical	18⅛	19⅛	14	15⅞
41	15⅛	Anglo-Chile Nitrate	29	41	28	34⅛
29⅛	22⅛	Archer-Daniels-Midland	24⅛	29⅛	23⅛	23⅛
8⅛	5⅛	Armour, Ill., A	7⅛	7⅛	6⅛	6⅛
51⅛	36⅛	Atlantic Refining	50⅛	51⅛	42	45
106	81⅛	Atlas Powder	102	103⅛	84	89⅛
70⅛	60⅛	Beechnut Packing	64	66⅛	61⅛	....
78	70	Bon Ami, A	....	78	74⅛	....
28	28	California Petroleum	....	....	....	....
35	23	Celanese	24⅛	28	23	24
20	13⅛	Celluloid Corp	....	16⅛	15	16⅛
15⅛	9⅛	Certainteed	12⅛	13⅛	9⅛	10⅛
32⅛	24⅛	Chickasha Cotton Oil	25	32⅛	25	....
63⅛	59⅛	Colgate-Palmolive-Peet	....	63⅛	59⅛	....
199	160⅛	Columbian Carbon	182	190⅛	160⅛	162
38	27⅛	Commercial Solvents	36⅛	38	31⅛	32⅛
111⅛	87⅛	Corn Products	101⅛	111⅛	98⅛	105⅛
43⅛	28⅛	Davison Chemical	42⅛	43⅛	35⅛	36⅛
42⅛	30⅛	Devoe & Raynolds	....	41⅛	35⅛	40⅛
100	71	Dow Chemical	....	100	72⅛	....
145⅛	112⅛	Du Pont	139⅛	145⅛	129	133⅛
120⅛	114⅛	Du Pont, 6 pc. deb	120⅛	120⅛	118⅛	119⅛
21	13⅛	Duval Texas Sulphur	....	21	15⅛	....
255⅛	175⅛	Eastman Kodak	237⅛	255⅛	231	249
33⅛	24⅛	Firestone Tire	29⅛	29⅞	24⅛	24⅛
5⅛	3	Fisk Rubber	4⅛	5⅛	3⅛	3⅛
55⅛	38⅛	Freeport Texas	47	55⅛	45	50⅛
71⅛	49⅛	General Asphalt	66⅛	71⅛	60⅛	60⅛
14⅛	8	Gen. Industrial Alcohol	10	12⅛	8⅛	11
38	27⅛	Glidden Co	35⅛	37	27⅛	29⅛
47⅞	37⅛	Gold Dust	43	47⅞	41⅛	45⅛
58⅛	38⅛	Goodrich Co	56⅛	57⅛	38⅛	40
85	78⅛	Hercules Powder	83	84⅛	80	....
23	20	Heyden Chemical	....	21	20	....
116⅞	52⅛	Houston Oil	103⅛	116⅞	96	109
7	5⅛	Imperial Chemical Ind	....	....	....	....
124	90	Industrial Rayon	117	117	105	....
8⅛	4⅛	Int. Ag. Chemical	7⅛	8⅛	6	6⅛
44⅛	31⅛	International Nickel	42⅛	44⅛	34⅛	34⅛
18	12⅛	International Paper, C	15	18	14⅛	15⅛
88⅛	69	International Salt	80	88⅛	80	88⅛
25	20⅛	Kellogg, Spencer & Sons	22⅛	25	21⅛	22⅛
6⅛	3⅛	Kelly-Springfield	5⅛	6⅛	4⅛	4⅛
11	6⅛	Lee Rubber & Tire	10⅛	10⅛	7⅛	7⅛
36	29⅛	Lehn & Fink	....	36	31	31
31	19⅛	Libby-Owens	28	30⅛	26	26⅛
81⅛	52⅛	Liquid Carbonic	78⅛	80	65⅛	70
37⅛	25⅛	McKesson & Robbins	29	37⅛	29	31
51⅛	37⅛	Mathieson Alkali	49⅛	50⅛	44⅛	46⅛
63⅛	48⅛	Monsanto Chemical	53⅛	63⅛	52	59
39⅛	29	Nat'l Distillers Products	34⅛	38⅛	32⅛	34⅛
189⅛	137	National Lead	170⅛	173	148	....
91⅛	66⅛	New Jersey Zinc	....	89⅛	80	80
85	51	Newport Co., A	....	78⅛	75⅛	....
74⅛	66⅛	Ohio Oil	74⅛	74⅛	69⅛	74⅛
60⅛	52⅛	Owens-Ill. Glass	59⅛	60⅛	55	....
44⅛	29⅛	Phillips Petroleum	39	44⅛	38	44⅛
59⅛	53	Pittsburgh Plate Glass	....	59⅛	55	....
57⅛	53⅛	Pratt & Lambert	....	56⅛	54⅛	....
76⅛	52⅛	Procter & Gamble	66⅛	76⅛	66⅛	75
27⅛	21⅛	Pure Oil	25⅛	27⅛	25	25⅛
85	80	Sherwin-Williams	....	85	85	....
34⅛	18	Silica Gel	33	34⅛	24	25⅛
32	21⅛	Sinclair Oil	31⅛	32	27⅞	29⅛
42	28⅛	Skelly Oil	38	42	34⅛	39
75	55⅛	Standard Oil, Cal	68⅛	75	65⅛	74⅛
84⅛	58	Standard Oil, N. J	76⅛	84⅛	72⅛	83⅛
40⅛	31⅛	Standard Oil, N. Y	38⅛	40⅛	34⅛	39⅛
3	1⅛	Standard Plate Glass	2⅛	2⅛	2	2
70	53	Sun Oil	64⅛	70	64	66
....	....	Swan & Finch	....	....	....	....
34⅛	30	Swift & Co	31	31⅛	30	30⅛
17	13	Tennessee Copper & Chemical	16	17	13⅞	14⅛
59⅛	50⅞	Texas Corporation	58⅛	59⅛	57	58⅛
67⅛	54⅛	Texas Gulf Sulphur	64⅛	65⅛	60⅛	60⅞
17⅛	10⅛	Tidewater Assoc. Oil	16⅛	17⅛	14⅛	17
106⅛	76	Union Carbide	104⅛	106⅛	88⅛	89⅛
50	41⅛	Union Oil, Cal	46⅛	50	45⅛	47⅛
84	44⅛	United Carbon	69⅛	84	65⅛	76⅛
42	19⅛	United Chemicals	....	34⅛	30	....
32⅛	25	United Piece Dye	....	32⅛	28	28
139⅛	87⅛	U. S. Industrial Alcohol	105	106⅛	87⅛	89⅛
15⅛	7⅛	U. S. Leather	10⅛	15⅛	10	....
35	21⅛	U. S. Rubber	33⅛	35	26⅛	29⅛
97⅛	88⅛	Vacuum Oil	91⅛	97⅛	89⅛	96⅛
143⅛	49⅛	Vanadium Corp	108⅛	143⅛	103	133⅛
47⅛	37⅛	Vick Chemical	44⅛	47⅛	43⅛	47
8⅛	5⅛	Va.-Ca Chemical	8⅛	8⅛	6⅛	6⅛
29⅛	22⅛	Wesson Oil	28⅛	29⅛	25	25⅛
59⅛	37	Westvaco Chlorine	53⅛	55⅛	47	50
7⅛	3⅛	Wilson & Co	6⅛	6⅛	4⅛	....

ECONOMIC INFLUENCES

on production and consumption of CHEMICALS

Chemical Production Underwent Curtailment in April

Activities in First Quarter Below Those for Comparable Period of 1929

AMERICAN manufacturing and trade closed the first third of the year in rather an unsatisfactory manner. Not only have most of the business expectations set up at the opening of the year failed to materialize, but there now seems little indication of any material improvement until after the summer season. The average rate of general manufacturing during April, as indicated by consumption of electric power, was about 1.6 per cent under March and 9.8 per cent under April last year. The chemical products industry appears to have witnessed a 3.5 per cent drop in activity during April as compared with March. The volume of general trade during April as indicated by check payments in 141 cities, was about 4.3 per cent under March and 15.6 per cent under April 1929.

While general business operations have not attained the hoped-for volume, there are present some very favorable underlying influences. American industry is carrying out the construction program forecast at the opening of the year, although residential building has remained on a comparatively low plane; there is a manifest adjustment of production of goods to current consumption; continued cautious, prudent merchandising policies mark retail distribution; and credit continues easy with a rise in the volume of new capital requirements.

FIGURES now at hand covering operations within the chemical and allied industries for the first quarter of the year bear out earlier estimates that these industries were not holding to the high plane of activity that characterized the first quarter of 1929. Financial reports likewise have been less favorable than those issued a year ago, and in many cases net earnings have been affected not only by the smaller tonnages shipped from producing plants but also by the smaller margin of profit which has followed as a result of lower sales prices.

Some branches of the chemical industry appear to have made progress during the first quarter and to have topped the totals reported for last year. In general, however, the comparison is less favorable and the majority of consuming industries are found to have been subjected to some curtailment during the quarter. Fertilizer consumption in the Southern states made a creditable showing and petroleum refining shows up a little ahead of last year. The textile industry has proved disappointing and has failed to take its full quota of chemicals.

The position of some of the producing and consuming branches of the chemical industry may be inferred from the following statistics:

Production	March, 1929	March, 1930	Jan.-March 1929	Jan.-March 1930	Per Cent of Change
Automobiles					
Passenger cars, No.	513,344	335,789	1,266,434	846,127	—33.2
Taxis, No.	2,079	1,389	6,251	2,983	—52.3
Trucks, No.	70,032	64,200	180,225	149,456	—17
Acetate of lime, 1,000 lb.	12,397	11,188	35,792	32,574	— 9
Methanol, crude, gal.	725,662	657,853	2,111,842	1,988,771	— 5.8
Methanol, refined, gal.	494,435	398,476	1,438,736	1,041,846	—27.5
Byproduct coke, 1,000 tons	4,613	4,394	13,063	12,594	— 3.5
Ethyl alcohol, 1,000 proof gal.	14,858	10,151	43,970	32,695	—25.6
Glass containers, 1,000 gross	2,574	2,527	7,202	6,937	— 3.6
Linseed oil, 1,000 lb.	.....	.....	202,353	145,970	—27.8
Petroleum, run to stills, 1,000 bbl.	80,708	80,252	231,564	232,829	+ 0.5
Wood rosin, bbl.	37,361	44,964	108,278	125,533	+15.9
Wood turpentine, bbl.	7,059	8,129	20,842	23,117	+10.9
Pine oil, gal.	235,445	280,560	678,848	774,398	+14.1
Consumption					
Silk, in textiles, bales	49,878	50,863	153,455	158,398	+ 3.2
Cotton, in textiles, bales	555,986	477,678	1,894,675	1,581,015	—16.5
Fertiliser, in South, tons	2,117,969	1,877,961	3,386,777	3,453,405	+ 1.9
Cottonseed oil, bbl.	272,600	234,115	869,313	840,051	— 3.4

Reports from Texas state that production of sulphur in that state for the first quarter of this year amounted to 580,528 tons, which compares with production of 608,845 tons in the corresponding quarter of 1929.

MANUFACTURING production in March, after adjustments for seasonal changes, showed no change from the preceding month but was considerably below the same period a year ago, according to the weighted index of the Federal Reserve Board. The output of minerals in March showed declines from both February, and March, 1929. Industrial production, including both manufacturing and minerals, while slightly less than the preceding month showed a decline of 12.4 per cent when compared with March a year ago.

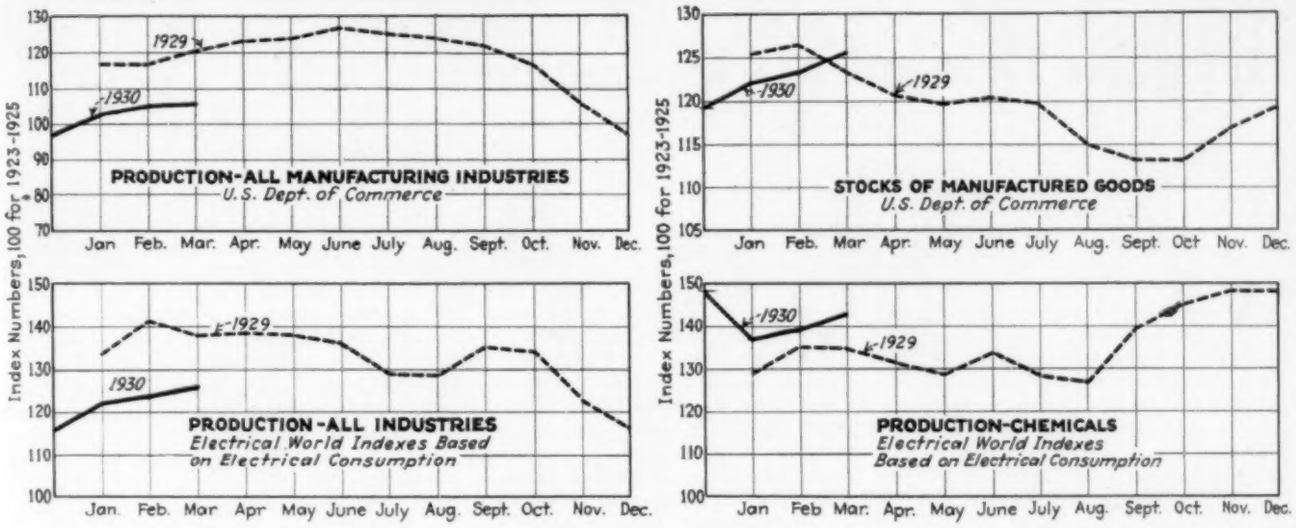
The general index of commodity stocks held at the end of March, while below the February level, showed a gain over a year ago, the increase over last year being solely due to a gain in the holdings of raw materials. The Index of stocks of finished goods in the hands of manufacturers showed a slight increase over February, and March of last year.

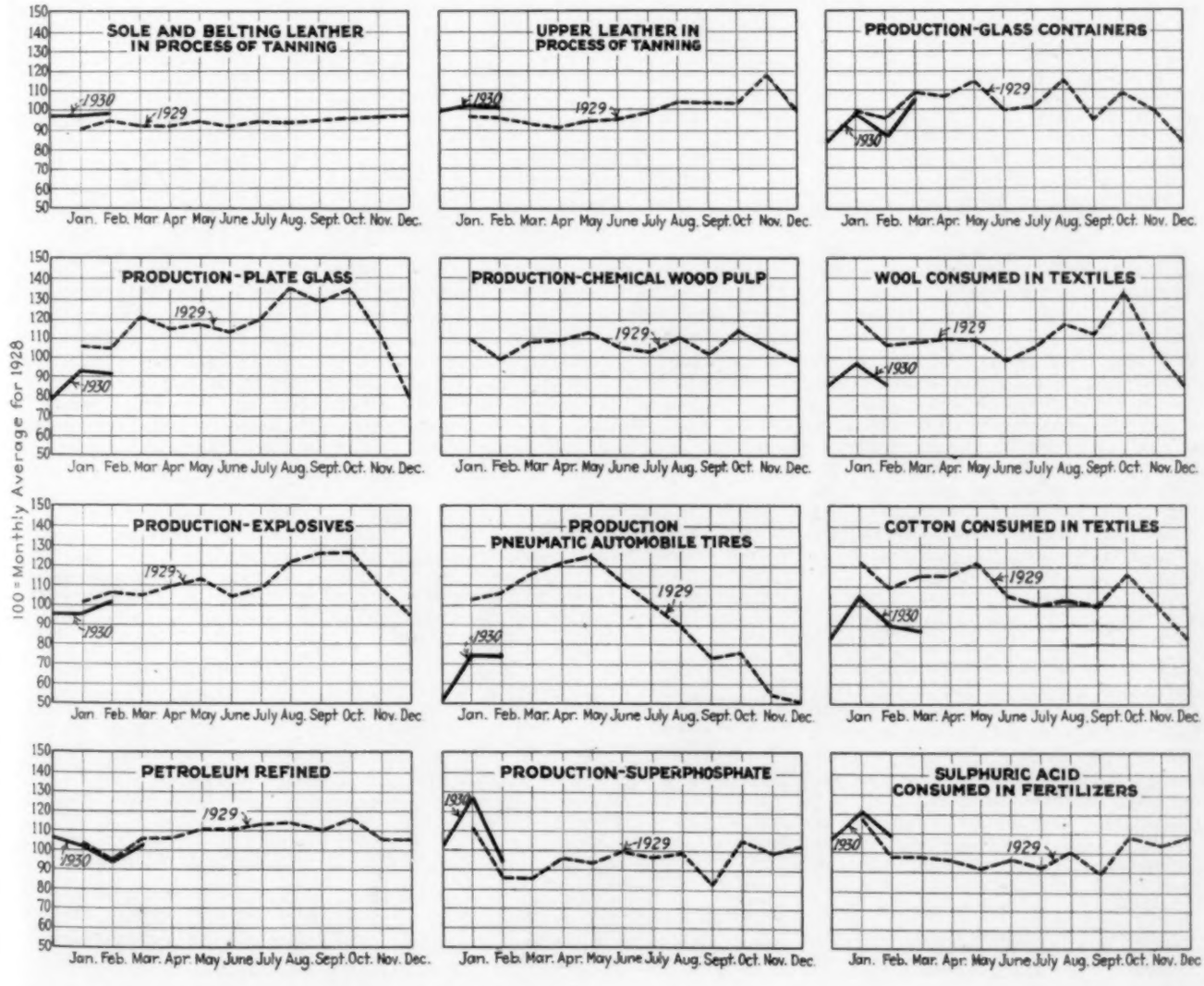
Unfilled orders for manufactured goods at the end of March showed a gain over February but declined from March, 1929. Increases were registered over the preceding month in orders for transportation equipment, principally railroad, lumber, and iron and steel, while a decline occurred in unfilled orders for textiles. In comparison with a year ago, gains in transportation equipment were more than offset by declines in lumber and textiles. Iron and steel showed no change from March, 1929.

In a report based upon the replies received to a questonnaire sent out on the present business outlook, the president of the National Credit Office announced that the consensus of opinion of industrial leaders who contributed data for the survey, and who estimated the course of their business during the next three quarters of the year, in terms of percentage, as against the corresponding quarters in 1929, was that the second and third quarters of the year would witness somewhat lower sales than did the same quarters of 1929, while sales for the fourth quarter would be above those of the former year.

"In view of the fact that many industries established new records for sales and earnings during the first three months of 1929, the average decline of slightly more than 10 per cent in sales and 17 per cent in profits, as indicated by the replies received, do not seem indicative of a seriously depressed condition. Encouraging too are the figures for unfilled orders and inventories, the former being 17 per cent lower than a year ago, while the latter has gained less than 10 per cent."

ACTIVITY IN PRODUCING AND CONSUMING INDUSTRIES


PRODUCTION-ALL MANUFACTURING INDUSTRIES
U.S. Dept. of Commerce
STOCKS OF MANUFACTURED GOODS
U.S. Dept. of Commerce
PRODUCTION-ALL INDUSTRIES
Electrical World Indexes Based on Electrical Consumption
PRODUCTION-CHEMICALS
Electrical World Indexes Based on Electrical Consumption
Index Numbers, 100 for 1923-1925
1929
1930
Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec



MARKET CONDITIONS AND PRICE TRENDS

Irregular Demand Marks Trading in Chemicals

Increase in Spot Sales Offset by Retarded Contract Movement

WHILE THE call for chemical products in the last month was disappointing, inasmuch as the movement to consumers failed to hold the accelerated rate which was in evidence in the preceding month, there was more interest shown in spot supplies, and small-lot orders for immediate shipment were regarded as an indication that consumers are not carrying large reserve stocks. Shipping instructions against existing contracts have been delayed in numerous cases, which offers an explanation for the slower position of the market for the year to date but also is an indication that the output of finished products is being held down in conformance with the respective consuming outlets.

Developments in domestic markets during the month have included a revision of discounts to the dealer trade in the sale of lead pigments, the establishment of commercial production of synthetic ethyl alcohol, and the issuing of new regulations regarding the denaturing of ethyl acetate.

In the latter part of April a reduction was made in the quotations for white lead and other lead pigments. This was accompanied by a revision in the discounts granted to dealers. For several years the discount rates had held at unchanged levels with a range depending on quantity. The new rates likewise are graduated on a quantity basis, but are more generous to the dealers and are expected to encourage greater sales efforts and thus result in a larger sale of these pigments.

WITH the remembrance of the effect that production of synthetic methanol exerted upon the wood distillation branch of the chemical industry, the industrial alcohol trade has been attentive to reports that production of synthetic ethyl alcohol was in the offing. In April, commercial production of ethyl alcohol was started in one plant. The plant capacity, however, is not large and the greater part of the output for this year, at least, will not find its way into the market, as it will be consumed by the producing company. The new project, therefore, is important as a development of technology and as a progressive advance within the industry rather than as a factor which might have a disturbing effect.

On May 1, the Commissioner of Prohibition announced that a change in regulations had been made which provided that all ethyl acetate on the premises of manufacturers on June 1 or manufactured after that date shall be denatured by adding to every 100 gal. of ethyl acetate one-eighth gal. of a petroleum product known as "calol ethatate" or a product similar in all respects, including that of denaturing value. Experimental work has been carried out for some time with a view of developing a denaturant which would serve the purpose intended and at the same time would be free from toxic qualities. Calol ethatate is not a patented product and may be produced by any oil refiner, although its use in denaturing ethyl acetate will not be extensive enough to encourage any large production.

BECAUSE of its importance from a tonnage standpoint, the most important development of the month in foreign markets is concerned with the nitrogen situation. Reports from Europe have referred to a meeting at Berlin at which representatives of cyanamide producers from sixteen countries were present. No information has been given regarding the purpose or outcome of the meeting, but it is rumored that limitation of production was discussed and the status of the industry defined in its relationship to the international nitrogen agreement.

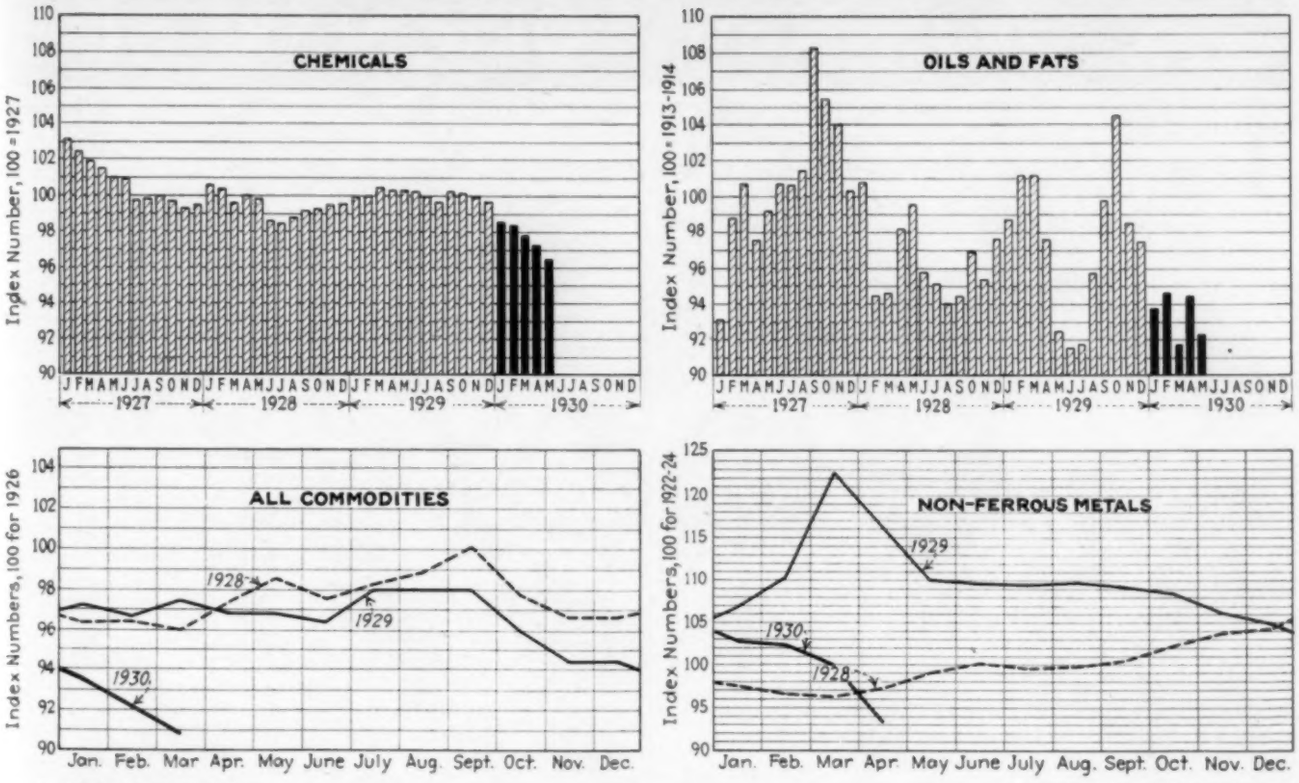
An international conference of nitrogen interests also was reported to have met in Paris with Chilean nitrate interests in attendance. Developments in Chilean nitrate are reported to involve the formation of a holding company. The former Chilean Minister of Finance is quoted as authority for the statement that a bill would shortly be introduced in the Congress of Chile which would authorize the formation of a company which would consolidate all nitrate producers into one concern. The Chilean government would own one-half the stock of the new company and the remaining stock would be used to acquire the various companies now engaged in the nitrate business in Chile. The export tax also is scheduled for abolishment, with the government revenue to be derived from its pro-rata share in the profits of the industry. Authentic reports apparently are not available, as some of the nitrate companies are not inclined to credit the reports so far made public, especially the report that the proposed company is to include all producers.

Production of nitrate of soda in 1929 was the largest for any year since the war and while export shipments were large, they were in excess of consuming requirements and world stocks at the end of the year were more than 500,000 tons larger than at the close of 1928. A short time ago the Association of Nitrate Producers, at the suggestion of the government, approved a reduction in production of about 50,000 tons a month.

Factory Operations in Vegetable Oils

	Production		Consumption		Factory and Warehouse Stocks	
	Jan.-March, 1929 Lb.	Jan.-March, 1930 Lb.	Jan.-March, 1929 Lb.	Jan.-March, 1930 Lb.	March 31, 1929 Lb.	March 31, 1930 Lb.
Cottonseed, crude	522,824,575	500,203,812	544,134,745	493,203,812	106,954,831	101,921,509
Cottonseed, refined	500,415,614	449,577,650	303,618,393	287,591,151	584,978,238	535,890,768
Peanut, crude	4,462,713	12,112,350	4,078,642	4,440,557	1,814,304	1,514,717
Peanut, refined	3,381,316	3,033,645	2,503,682	2,258,184	1,581,786	4,423,037
Coconut, crude	90,175,368	90,688,722	162,062,793	166,131,337	116,267,405	162,968,464
Coconut, refined	83,755,347	76,800,662	75,542,900	78,593,942	14,493,772	17,992,922
Corn, crude	36,350,888	28,272,262	43,786,840	35,659,812	12,496,670	8,600,452
Corn, refined	36,317,998	26,611,404	9,179,749	6,296,682	11,791,087	12,355,193
Soya-bean, crude	3,082,740	3,234,985	6,400,730	4,573,833	8,228,961	12,636,912
Soya-bean, refined	2,367,175	788,506	1,094,027	2,049,011	1,420,293	4,053,111
Olive, edible	583,081	808,995	353,434	320,618	4,940,142	5,527,999
Olive, inedible	12,925	.....	1,515,936	1,503,612	1,567,953	1,742,512
Sulphur oil	.....	.....	9,852,216	9,929,217	6,019,096	12,372,510
Palm-Kernel, crude	.....	379,403	10,822,998	12,729,416	18,491,038	20,884,450
Palm-Kernel, refined	3,985,123	3,617,626	3,669,525	3,678,337	905,753	899,896
Rapeseed	.....	.....	3,417,688	3,038,087	3,263,270	6,141,126
Linseed	200,122,772	145,969,802	121,575,007	95,601,333	181,438,594	154,831,899
China wood	.....	.....	23,296,823	24,974,543	24,595,764	31,426,002
Castor	24,125,847	15,583,860	8,621,218	5,460,350	7,872,008	13,380,181
Palm	.....	.....	43,096,864	49,425,711	28,716,498	46,360,638
All other	2,280,812	2,247,492	2,467,751	4,539,637	2,817,701	17,226,668

CHEM. & MET. *Weighted Indexes of* PRICES


CHEMICALS
Index Number, 100 = 1927
OILS AND FATS
Index Number, 100 = 1913-1914
ALL COMMODITIES
Index Numbers, 100 for 1926
1928
1929
1930
NON-FERROUS METALS
Index Numbers, 100 for 1922-24
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1927
1928
1929
1930
Jan. Feb. Mar Apr. May June July Aug. Sept. Oct. Nov. Dec.

U. S. Department of Labor — *Engineering & Mining Journal*

Chemical Prices Reflect Slower Consuming Demand

COMPETITIVE selling is still prominent in the market for chemicals, with producers eager to reduce holdings and with supplies patently in excess of current consuming needs. Sales of such important chemicals as caustic soda, soda ash, chlorine, and ammonia have been made below prevailing quotations and a buyers' market is in prospect for some time to come. Demand for chlorine has been especially poor and in some cases the check placed upon production has limited the supply of electrolytic caustic soda.

Lower production costs have warranted downward revisions in the metal salts, and conditions surrounding metals are not encouraging for any immediate recovery in values. Bichloride of tin is in a nominal position, as producers do not find it profitable to continue manufacture of the limited amounts which are in demand.

The nitrogen situation is becoming more complicated, because of attempts to form a working agreement of world producers, with Chilean nitrate factors threatening a price war.

Calcium chloride has been more active than the majority of chemicals and, with good prospects for future distribution, current prices are reported to be firm.

Acetate of lime appears in a weak position, with shipments for the first quarter of the year reaching a total of 16,561,297 lb., as compared with 34,863,063 lb. shipped from producing works in the first quarter of 1929. Synthetic acetic acid also is reported to have offered greater competition to the natural product.

Rosin and turpentine have shown a downward price tendency. Receipts are expected to be large for the next month and, while supplies at primary points are not unduly large, the supplies in some consuming markets are heavy enough to be regarded as a bearish factor.

Vegetable oils have been in large supply for some months and relatively low prices are in effect. Under ordinary conditions, the reduction in the size of the Argentine exportable seed crop would be construed as bullish, but European demand has been light and a large seed supply is expected to be grown in the American Northwest this season, so that radical departures from present oil values are not anticipated.

Consumption of China wood oil has held up surprisingly well so far this year. Stocks, however, are large and shipments from Hankow to this country in April amounted to 9,200,000 lb.

Chem. & Met. Weighted Index of Chemical Prices

Base = 100 for 1927

This month	**96.54**
Last month	97.36
May, 1929	100.31
May, 1928	99.85

The price tone was easy during the month with sales of basic chemicals, including alkalis, going through below the openly quoted figures. Lower schedules were operative for alcohol, white lead, formaldehyde, and turpentine and the weighted number showed these influences.

Chem. & Met. Weighted Index of Prices for Oils and Fats

Base = 100 for 1927

This month	**92.24**
Last month	94.46
May, 1929	92.52
May, 1928	99.62

Downward revisions in price schedules were almost universal during the period. Crude cottonseed oil and menhaden oil were largely nominal. Linseed oil dropped to 14c. per lb. in cooperage and lower prices ruled for China wood, and coconut oils with tallow also lower.

CURRENT PRICES *in the* NEW YORK MARKET

THE following prices refer to round lots in the New York Market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to May 10.

Industrial Chemicals

	Current Price	Last Month	Last Year
Acetone, drums, lb.	$0.11 - $0.12	$0.11 - $0.12	$0.14 - $0.15
Acid, acetic, 28%, bbl., cwt.	3.88 - 4.03	3.88 - 4.03	3.88 - 4.03
Boric, bbl, lb.	.06½ - .07	.06½ - .07	.06½ - .07
Citric, kegs, lb.	.46 - .47	.46 - .47	.46 - .47
Formic, bbl, lb.	.10½ - .11	.10½ - .11	.10½ - .11
Gallic, tech., bbl., lb.	.50 - .55	.50 - .55	.50 - .55
Hydrofluoric 30% carb, lb.	.06 - .07	.06 - .07	.06 - .07
Latic, 44%, tech., light, bbl., lb.	.11½ - .12	.11½ - .12	.11½ - .12
22%, tech., light, bbl., lb.	.05½ - .06	.05½ - .06	.05½ - .06
Muriatic, 18°, tanks, cwt.	1.00 - 1.10½	1.00 - 1.10	1.00 - 1.10
Nitric, 36°, carboys, lb.	.05 - .05½	.05 - .05½	.05 - .05½
Oleum, tanks, wks., ton	18.50 - 20.00	18.50 -	18.00 - 20.00
Oxalic, crystals, bbl., lb.	.11 - .11½	.11 - .11½	.11 - .11½
Phosphoric, tech., c'bys., lb.	.08½ - .09	.08½ - .09	.08½ - .09
Sulphuric, 60°, tanks, ton	11.00 - 11.50	11.00 - 11.50	11.00 - 11.50
Tannic, tech., bbl., lb.	.35 - .40	.35 - .40	.35 - .40
Tartaric, powd., bbl., lb.	.37½ - .39	.37½ - .39	.38 - .39
Tungstic, bbl., lb.	1.40 - 1.50	1.40 - 1.50	1.00 - 1.20
Alcohol, ethyl, 190 p'f., bbl., gal.	2.63 -	2.63 - 2.71	2.68½ - 2.71
Alcohol, Butyl, tanks, lb.	16½ - .17	.16½ - .17	.17½ - .18
Alchol, Amyl	-	-	-
From Pentane, tanks, lb.	.236-	.236-	-
Denatured, 190 proof			
No. 1 special dr., gal.	.43 -	.43 -	.49 -
No. 5, 188 proof, dr., gal.	.42 -	.44 -	.49 -
Alum, ammonia, lump, bbl., lb.	.03½ - .04	.03½ - .04	.03½ - .04
Chrome, bbl., lb.	.05½ - .05½	.05½ - .05½	.05½ - .06
Potash, lump, bbl., lb.	.03½ - .04	.03 - .03½	.02½ - .03½
Aluminum sulphate, com., bags, cwt.	1.40 - 1.45	1.40 - 1.45	1.40 - 1.45
Iron free, bg., cwt.	1.90 - 2.00	2.00 - 2.10	2.00 - 2.10
Aqua ammonia, 26°, drums, lb.	.03 - .04	.03 - .04	.03 - .04
Ammonia, anhydrous, cyl., lb.	.15 -	.15 -	.14 -
Ammonium carbonate, powd. tech., casks, lb.	.12½ - .13	.12½ - .13	.12 - .13
Sulphate, wks., cwt.	2.10 -	2.10 -	2.30 -
Amylacetate tech., tanks, lb., gal.	2.22 -	2.22 -	-
Antimony Oxide, bbl., lb.	.09 - .10	.09 - .10	.09 - .10
Arsenic, white, powd., bbl., lb.	.04 - .04½	.04 - .04½	.04 - .04½
Red, powd., kegs., lb.	.09 - .10	.09 - .10	.09 - .10
Barium carbonate, bbl., ton	58.00 - 60.00	58.00 - 60.00	57.50 - 60.00
Chloride, bbl., ton	63.00 - 65.00	65.00 - 67.00	64.00 - 70.00
Nitrate, cask, lb.	.07 - .07½	.07½ - .08	.08 - .08½
Blanc fixe, dry, bbl., lb.	.03½ - .04	.03½ - .04	.04 - .04½
Bleaching powder, f.o.b., wks., drums, cwt.	2.00 - 2.10	2.00 - 2.10	2.00 - 2.10
Borax, bbl., lb.	.033- .033	.033- .033	.02½ - .03
Bromine, cs., lb.	.45 - .47	.45 - .47	.45 - .47
Calcium acetate, bags., cwt.	4.50 -	4.50 -	4.50 -
Arsenate, dr., lb.	.07 - .08	.07 - .10	.06½ - .07
Carbide drums, lb.	.05 - .06	.05 - .06	.05 - .06
Chloride, fused, dr., wks., ton.	20.00 -	20.00 -	20.00 -
flake, dr., wks., ton.	22.75 -	22.75 -	22.75 -
Phosphate, bbl., lb.	.08 - .08½	.08 - .08½	.07 - .07½
Carbon bisulphide, drums, lb.	.05½ - .06	.05½ - .06	.05 - .06
Tetrachloride drums, lb.	.06½ - .07	.06½ - .07	.06½ - .07
Chlorine, liquid, tanks, wks., lb.	.02½ -	.02½ -	.03 -
Cylinders	.04½ - .06	.04½ - .06	.05 - .08
Cobalt oxide, cans, lb.	2.10 - 2.20	2.10 - 2.20	2.10 - 2.25
Copperas, bgs., f.o.b. wks., ton	13.00 - 14.00	15.00 - 16.00	16.00 - 17.00
Copper carbonate, bbl., lb.	.10 - .18	.13 - .20	.19 - .21
Cyanide, tech., bbl., lb.	.45 - .46	.49 - .50	.49 - .50
Sulphate, bbl., cwt.	4.50 - 5.00	5.50 - 6.00	6.00 - 6.10
Cream of tartar, bbl., lb.	.26½ - .27	.26½ - .27	.27½ - .28
Diethylene glycol, dr., lb.	.11 - .13	.11 - .13	.10 - .15
Epsom salt, dom., tech., bbl., cwt.	1.75 - 2.15	1.75 - 2.00	1.75 - 2.00
Imp., tech., bags, cwt.	1.15 - 1.25	1.15 - 1.25	1.15 - 1.25
Ethyl acetate, drums, lb.	.121-	.121-	.125-
Formaldehyde, 40%, bbl., lb.	.07½ - .08	.07½ - .08	.09½ - .10
Furfural, dr., lb.	.10 - .12	.15 - .17½	.15 - .17
Fusel oil, crude, drums, gal.	1.30 - 1.40	1.30 - 1.40	1.30 - 1.40
Refined, dr., gal.	1.90 - 2.00	1.90 - 2.00	2.50 - 3.00
Galubers salt, bags, cwt.	1.10 - 1.20	1.10 - 1.20	1.00 - 1.10
Glycerine, c.p., drums, extra., lb.	.14 - .14½	.14 - .14½	.14 - .15
Lead:			
White, basic carbonate, dry casks, lb.	.07½ -	.08½ -	.08½ -
White, basic sulphate, sck., lb.	.07½ -	.07½ -	.08 -
Red, dry, sck., lb.	.09 -	.09½ -	.10½ -
Lead acetate, white crys., bbl., lb.	.13 - .14	.13 - .14	.13 - .13½
Lead arsenate, powd., bbl., lb.	.13 - .14	.14 - .15	.12 - .13
Lime, chem., bulk, ton	8.50 -	8.50 -	8.50 -
Litharge, pwd., csk, lb.	.08 -	.08½ -	.08½ -
Lithopone, bags, lb.	.05½ - .06	.05½ - .06	.05½ - .06½
Magnesium carb., tech., bags, lb.	.06 - .06½	.06 - .06½	.06½ - .07
Methanol, 95%, tanks, gal.	.38½ -	.38½ -	.55 -
97%, tanks, gal.	.39 -	.39 -	.55 -
Synthetic, tanks, gal.	.40½ - .45	.40½ -	
Nickel salt, double, bbl., lb.	.13 - .13½	.13 - .13½	.13 - .13½
Single, bbl., lb.	.13 - .13½	.13 - .13½	.13 - .13½
Orange mineral, csk., lb.	.11 -	.11½ -	.12½ -
Phosphorus, red, cases, lb.	.42 - .44	.42 - .44	.55 - .57
Yellow, cases, lb.	.31 - .32	.31 - .32	.32 - .33
Potassium bichromate, casks, lb.	.09 - .09½	.09 - .09½	.09 - .09½
Carbonate, 80-85%, calc., csk., lb	.05½ - .06	.05½ - .06	.05½ - .06
Chlorate, powd., lb.	.08½ - .09	.08½ - .09	.07½ - .08½
Cyanide, cs., lb.	.52 - .55	.52 - .55	.51 - .53
First sorts, csk., lb.	.08½ - .09	.08½ - .09	.08½ - .09
Hydroxide (caustic potash) dr., lb	.06½ - .06½	.06½ - .06½	.07½ - .07½
Muriate, 80% bgs., ton	37.15 -	36.75 -	36.40 -
Nitrate, bbl., lb.	.06 - .06½	.06 - .06½	.06 - .07½
Permanganate, drums, lb.	.16 - .16½	.16 - .16½	.15 - .16
Prussiate, yellow, casks, lb	.18½ - .19½	.18½ - .19	.19 - .19½
Sal ammoniac, white, casks, lb	.046- .05	.046- .05	.047- .05
Salsoda, bbl., cwt.	.90 - .95	.90 - .95	.90 - .95
Salt cake, bulk, ton	22.00 - 25.00	22.00 - 24.00	16.00 - 18.00
Soda ash, light, 58%, bags, contract, cwt.	1.32 -	1.32 -	1.32 -
Dense, bags, cwt.	1.35 -	1.35 -	1.35 -
Soda, caustic, 76%, solid, drums, contract, cwt.	2.90 - 3.00	2.90 - 3.00	2.90 - 3.00
Acetate, works, bbl., lb.	.04 - .05	.03 - .04	.05 - .05½
Bicarbonate, bbl., cwt.	2.00 - 2.25	2.00 - 2.25	2.00 - 2.25
Bichromate, casks, lb.	.07 - .07½	.07 - .07½	.07 - .07½
Bisulphate, bulk, ton	14.00 - 16.00	16.00 - 18.00	12.00 - 15.00
Bisulphite, bbl., lb.	.03½ - .04	.03½ - .04	.03½ - .04
Chlorate, kegs, lb.	.07½ - .08	.07½ - .08	.06½ - .06½
Chloride, tech., ton	12.00 - 14.75	12.00 - 14.75	12.00 - 14.00
Cyanide, cases, dom., lb.	.18 - .22	.18 - .22	.18 - .22
Fluoride, bbl., lb.	.08½ - .09	.08½ - .09½	.08½ - .09
Hyposulphite, bbl., lb.	2.40 - 2.50	2.40 - 2.50	2.50 - 3.00
Nitrate, bags, cwt.	2.10 -	2.16 -	2.15 -
Nitrite, casks, lb.	.07½ - .08	.07½ - .08	.07½ - .08
Phosphate, dibasic, bbl., lb.	.03 - .03¼	.03 - .03¼	.03½ - .03¾
Prussiate, yel. drums, lb	.11½ - .12	.11½ - .12	.11½ - .12
Silicate (30°, drums), cwt.	.60 - .70	.60 - .70	.75 - 1.15
Sulphide, fused, 60-62%, dr., lb.	.02½ - .03½	.02½ - .03	.03½ - .04
Sulphite, crys., bbl., lb.	.03 - .03½	.03 - .03½	.02½ - .03
Sulphur, crude at mine, bulk, ton	18.00 -	18.00 -	18.00 -
Chloride, dr., lb.	.05 - .06	.04 - .05	.04 - .05
Dioxide, cyl., lb.	.06½ - .07	.07 - .08	.09 - .10
Flour, bag, cwt.	1.55 - 3.00	1.55 - 3.00	1.55 - 3.00
Tin bichloride, bbl., lb.	nom. -	.12½ -	.14½ -
Oxide, bbl., lb.	.40 -	.40 -	.53 -
Crystals, bbl., lb.	.29½ -	.31 -	.35 -
Zinc chloride, gran., bbl., lb.	.06½ - .06½	.06½ - .06½	.06½ - .06½
Carbonate, bbl., lb.	.10½ - .11	.10½ - .11	.10 - .11
Cyanide, dr., lb.	.41 - .42	.40 - .41	.40 - .41
Dust, bbl., lb.	.07½ - .08	.08 - .08½	.09 - .10
Zinc oxide, lead free, bag, lb.	.06½ -	.06½ -	.06½ -
5% lead sulphate, bags, lb.	.06½ -	.06½ -	.06½ -
Sulphate, bbl., cwt.	3.00 - 3.25	2.75 - 3.00	2.75 - 3.00

Oils and Fats

	Current Price	Last Month	Last Year
Castor oil, No. 3, bbl., lb.	$0.12 - $0.12½	$0.12 - $0.13	$0.13½ - $0.14
Chinawood oil, bbl., lb.	.10½ -	.11½ -	.15 -
Coconut oil, Ceylon, tanks, N.Y., lb.	.06½ -	.06½ -	.07½ -
Corn oil crude, tanks, (f.o.b. mill), lb.	.07½ -	.07½ -	.08½ -
Cottonseed oil, crude (f.o.b. mill), tanks, lb.	.07½ -	.07½ -	.08 -
Linseed oil, raw, car lots, bbl., lb.	.14 -	.144 -	.101-
Palm, Lagos, casks, lb.	.07 -	.07½ -	.08½ -
Niger, casks, lb.	.06½ -	.07 -	.08 -
Palm Kernel, bbl., lb.	.07½ -	.07½ -	.08½ -
Peanut oil, crude, tanks (mill), lb	.07½ -	.07½ -	.08½ -
Rapeseed oil, refined, bbl., gal.	.70 - .72	.68 - .70	.82 - .84
Soya bean, tank (f.o.b. Coast), lb.	.09½ -	.09½ -	.09½ -
Sulphur (olive foots), bbl., lb.	.07½ -	.07½ -	.10½ -
Cod, Newfoundland, bbl., gal.	.55 - .57	.55 - .57	.65 - .67
Menhaden, light pressed, bbl., gal.	.63 - .65	.63 - .65	.70 - .72
Crude, tanks (f.o.b. factory), gal.	nom. -	nom. -	.48 -
Whale, crude, tanks, gal.	.78 -	.80 -	- .80
Grease, yellow, loose, lb.	.05½ -	.05½ -	.07 -
Oleo stearine, lb.	.08½ -	.09½ -	.09½ -
Red oil, distilled, d.p. bbl., lb.	.10½ -	.10½ -	.09½ - .09½
Tallow, extra, loose, lb.	.05½ -	.06½ -	.08½ -

Coal-Tar Products

	Current Price	Last Month	Last Year
Alpha-naphthol, crude, bbl., lb.	$0.60 - $0.65	$0.60 - $0.65	$0.60 - $0.62
Refined, bbl., lb.	.80 - .85	.80 - .85	.85 - .90
Alpha-naphthylamine, bbl., lb.	.32 - .34	.32 - .34	.35 - .36
Aniline oil, drums, extra, lb.	.15 - .15½	.15 - .15½	.15 - .16
Aniline salts, bbl., lb.	.24 - .25	.24 - .25	.24 - .25
Anthracene, 80%, drums, lb.	.60 - .65	.60 - .65	.60 - .65

Coal-Tar Products (Continued)

	Current Price	Last Month	Last Year
Benzaldehyde, U.S.P., dr., lb.	1.15 - 1.25	1.15 - 1.35	1.15 - 1.25
Benzidine base, bbl., lb.	.65 - .67	.65 - .67	.70 - .72
Benzoic acid, U.S.P., kgs, lb.	.57 - .60	.57 - .60	.58 - .60
Benzyl chloride, tech., dr., lb.	.25 - .26	.25 - .26	.25 - .26
Benzol, 90%, tanks, works, gal.	.21 - .23	.22 - .24	.22 - .23
Beta-naphthol, tech., drums, lb.	.22 - .24	.22 - .24	.22 - .24
Cresol, U.S.P., dr., lb.	.14 - .17	.14 - .17	.18 - .20
Cresylic acid, 97%, dr., wks., gal.	.60 - .70	.60 - .70	.73 - .75
Diethylaniline, dr., lb.	.55 - .58	.55 - .58	.58 - .60
Dinitrophenol, bbl., lb.	.30 - .32	.30 - .31	.31 - .35
Dinitrotoluen, bbl., lb.	.16 - .17	.16 - .17	.17 - .18
Dip oil, 25% dr., gal.	.26 - .28	.26 - .28	.28 - .30
Diphenylamine, bbl., lb.	.39 - .40	.39 - .40	.45 - .47
H-acid, bbl., lb.	.68 - .70	.68 - .70	.63 - .55
Naphthalene, flake, bbl., lb.	.04½ - .05	.04½ - .05	.05 - .06
Nitrobenzene, dr., lb.	.08½ - .09	.08½ - .09	.08½ - .10
Para-nitraniline, bbl., lb.	.51 - .55	.51 - .55	.52 - .53
Para-nitrotoluine, bbl., lb.	.29 - .30	.29 - .31	.28 - .32
Phenol, U.S.P., drums, lb.	.14½ - .15	.14½ - .15	.15 - .17
Picric acid, bbl., lb.	.30 - .40	.30 - .40	.30 - .40
Pyridine, dr., lb.	1.50 - 1.80	1.75 - 1.90	1.35 - 1.50
R-salt, bbl., lb.	.44 - .45	.44 - .45	.47 - .49
Resorcinal, tech., kegs, lb.	1.15 - 1.25	1.15 - 1.25	1.30 - 1.40
Salicylic acid, tech., bbl., lb.	.33 - .35	.33 - .35	.30 - .32
Solvent naphtha, w.w., tanks, gal	.28 - .30	.28 -	.35 - .....
Tolidine, bbl., lb.	.91 - .93	.91 - .93	.95 - .96
Toluene, tanks, works, gal.	.35 -	.35 -	.35 - .....
Xylene, com., tanks, gal.	.28 - .30	.28 - .30	.36 - .40

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl., ton.	$23.00-$25.00	$23.00-$25.00	$23.00-$25.00
Casein, tech., bbl., lb.	.14 - .16	.13½ - .15	.16 - .17
China clay, dom., f.o.b. mine, ton	8.00 -20.00	10.00 -20.00	10.00 -20.00
Dry colors:			
Carbon gas, black (wks.), lb.	.05 - .22	.05 - .22	.06½ - .07
Prussian blue, bbl., lb.	.35 - .36	.35 - .36	.31 - .32
Ultramine blue, bbl., lb.	.06 - .32	.06 - .32	.03 - .35
Chrome green, bbl., lb.	.27 - .28	.27 - .28	.27 - .30
Carmine red, tins, lb.	6.00 - 6.50	6.00 - 6.50	5.25 - 5.50
Para toner, lb.	.77 - .80	.77 - .80	.70 - .80
Vermilion, English, bbl., lb.	1.90 - 2.00	1.90 - 2.00	1.80 - 1.85
Chrome yellow, C. P., bbl., lb	.17 - .17½	.17 - .17½	.15½ - .16
Feldspar, No. 1 (f.o.b. N.C.), ton	6.50 - 7.50	6.50 - 7.50	5.75 - 7.00
Graphite, Ceylon, lump, bbl., lb	.04 - .05	.04 - .05	.08 - .09
Cum copal Congo, bags, lb.	.07 - .09	.07½ - .08	.07½ - .08
Manila, bags, lb.	.16 - .17	.16 - .17	.15 - .18
Damar, Batavia, cases, lb.	.16 - .16½	.18 - .19	.22 - .23
Kauri No. 1 cases, lb.	.48 - .50	.48 - .53	.48 - .53
Kieselguhr (f.o.b. N. Y.), lb.	50.00 -55.00	50.00 -55.00	50.00 -55.00
Magnesite, calc, ton	40.00 -	40.00 -	40.00 - .....
Pumice stone, lump, bbl., lb.	.05 - .07	.05 - .08	.05 - .07
Imported, casks, lb.	.03 - .40	.03 - .40	.03 - .35
Rosin, H., bbl.	7.10 -	8.40 -	8.45 - .....
Turpentine, gal.	.48 -	.55 -	.54 - .....
Shellac, orange, fine, bags, lb.	.50 - .52	.55 - .58	.61 - .62
Bleached, bonedry, bags, lb.	.36 - .37	.38 - .40	.56 - .60
T. N. bags, lb.	.27 - .28	.27 - .28	.46 - .47
Soapstone (f.o.b. Vt.), bags, ton	10.00 -12.00	10.00 -12.00	10.00 -12.00
Talc, 200 mesh (f.o.b. Vt.), ton.	9.50 -	9.50 -	10.50 - .....
300 mesh (f.o.b. Ga.), ton.	7.50 -10.00	7.50 -10.00	7.50 -11.00
225 mesh (f.o.b. N. Y.), ton.	13.75 -	13.75 -	13.75 - .....
Wax, Bayberry, bbl., lb.	$0.27 -$0.29	$0.27 -$0.29	$0.31 -$0.32
Beeswax, ref., light, lb.	.34 - .37	.36 - .37	.41 - .42
Candelilla, bags, lb.	.19 - .20	.19 - .20	.23 - .24
Carnauba, No. 1, bags, lb.	.31 - .32	.31 - .32	.50 - .51
Paraffine, crude			
105-110 m.p., lb.	.04 - .04½	.04¼ - .05	.04¼ - .05

Ferro-Alloys

	Current Price	Last Month	Last Year
Ferrotitanium, 15-18%, ton.	$200.00-	$200.00-	$200.00- .....
Ferromanganese, 78-82%, ton.	94.00-99.00	94.00-99.00	105.00- .....
Spiegeleisen, 19-21%, ton.	33.00-	33.00-	32.00- .....
Ferrosilicon, 14-17%, ton.	45.00-	45.00-	45.00- .....
Ferrotungsten, 70-80%, lb.	1.45	1.45-	1.35- ...
Ferro-uranium, 35-50%, lb.	4.50	4.50-	4.50- .....
Ferrovanadium, 30-40%, lb.	3.15- 3.50	3.15- 3.75	3.15- 3.75

Non-Ferrous Metals

	Current Price	Last Month	Last Year
Copper, electrolytic, lb.	$0.12½-	$0.17¾ -	$0.18 - .....
Aluminum, 96-99%, lb.	.24 - .30	.24 - .26	.24 - .25
Antimony, Chin. and Jap., lb.	.07½ -	.08 -	.09¼ - .....
Nickel, 99%, lb.	.35 -	.35 -	.35 - .....
Monel metal, blocks, lb.	.28 -	.28 -	.28 - .....
Tin, 5-ton lots, Straits, lb.	.31¾ -	.36¾ -	.44¼ - .....
Lead, New York, spot, lb.	.0545	.05¼	.07 - .....
Zinc, New York, spot, lb.	.05 -	.0495	.069 .....
Silver, commercial, oz.	.42¾ -	.42½ -	.54¾ - .....
Cadmium, lb.	.70 - .75	.80 - .85	.85 - .95
Bismuth, ton lots, lb.	1.20 - 1.35	1.70 -	1.70 - .....
Cobalt, lb.	2.50 -	2.10 - 2.50	2.50 - .....
Magnesium, ingots, 99%, lb.	.85 - 1.10	.85 - 1.10	.85 - 1.10
Platinum, ref., oz.	46.00 - 48.00	46.00- 48.00	70.00-70.00
Palladium ref., oz.	26.00 - 28.00	30.00- 35.00	42.00-46.00
Mercury, flask, 75 lb.	112.00-114.00	113.00-115.00	123.00- .....
Tungsten powder, lb.	1.70- 1.75	1.35- 1.50	1.10- 1.15

Ores and Semi-finished Products

	Current Price	Last Month	Last Year
Bauxite, crushed, wks., ton.	$7.50- $8.00	$7.50- $8.50	$5.50- $8.75
Chrome ore, c.f. post, ton.	21.50- 25.00	21.50- 25.00	22.00- 23.00
Coke, fdry., f.o.b. ovens, ton.	2.75- 2.85	2.75- 3.85	2.85- 3.00
Fluorspar, gravel, f.o.b. Ill., ton.	18.00- 20.00	18.00- 20.00	17.00- 18.00
Manganese ore, 50% Mn., c.i.f. Atlantic Ports, unit.	.31 - .36	.31 - .36	.36 - .38
Molybdenite, 85% MoS_2 per lb. MoS_2, N. Y., lb.	.48 - .50	.48 - .50	.48 - .50
Monazite, 6% of ThO_2, ton.	60.00-	60.00-	130.00- .....
Pyrites, Span. fines, c.i.f., unit.	.13 -	.13 -	.13 - .....
Rutile, 94-96% TiO_2, lb.	.10 - .11	.10 - .11	.11 - .13
Tungsten, scheelite, 60% WO_3 and over, unit.	15.25- 16.50	15.25 - 16.50	11.25 -11.50
Zircon, 99%, lb.	.03 -	.03 -	.03 - .....

CURRENT INDUSTRIAL DEVELOPMENTS

New Construction and Machinery Requirements

❖

Acetylene Plant—Prest-O-Lite Co., subsidiary of Union Carbide & Carbon Co. 30 East 42nd St., New York, N. Y., awarded contract for the construction of an acetylene plant at Casper, Wyo. to Carson & Schulze, Casper. Estimated cost $100,000.

Aluminite Insulating Material Factory — Philip Carey Co., Lockwood, Cincinnati, O., is having preliminary plans prepared for the construction of a plant for the manufacture of aluminite insulating blocks and bricks at East St. Louis, Ill. Estimated cost $500,000. T. A. Griffiths, c/o owner, is engineer.

Asphalt Plant — Lion Oil Refining Co., S. Dayson, Mgr., El Dorado, Ark., will build an asphalt plant. Estimated cost $250,000. Work will be done by day labor.

Plant—Union Carbide & Carbon Corp., 30 East 42nd St., New York, N. Y., plans the construction of a 1 and 2 story plant at Chattanooga, Tenn.

Carbon Plant — National Carbon Co., R. C. Frazer, Purch. Agt., West 117th St. and Madison Ave., Cleveland, O., had plans prepared for a 1 story addition to factory on West 76th St. Estimated cost $50,000. Private plans.

Carbon Black Plant—Texon Oil & Gas Co., Texon, Tex., plans the construction of a carbon black plant to use residue gas from Company's well in Reagan county. Estimated cost $150,000.

Cement Warehouse and Distribution Plant—Universal Atlas Cement Co., 208 La Salle St., Chicago, Ill., awarded contract for cement warehouse and distribution plant, including bulk unloading building, six tanks, 50 ft. high 24 ft. in diameter loading platform, 50 x 8 ft. conveyors, etc., at West St. and Second Ave. Private plans.

Kiln—St. Marys Cement Co., St. Marys, Ont., has work under way on the construction of a new steel kiln, 350 ft. long. Estimated cost $50,000. Electrical equipment will be installed.

Cement Plant Addition — Universal Cement Mold Co., 39th and Villard Sts., Milwaukee, Wis., awarded contract for the construction of 72 x 312 ft. silos, shipping room, machinery room, etc. at Canal St. to Worden-Allen Co., Port Washington Rd., Milwaukee. Estimated cost $79,290.

Plant — Russia Cement Co., Essex Ave., Gloucester, Mass., awarded contract for additional unit to plant for the manufacture of liquid belting cement from fish waste known as Le Page's Glue. Estimated cost $40,000. This corrects report in March issue of Chemical and Metallurgical Engineering.

Chemical Plant Unit — Merrimac Chemical Co., Everett, Mass., will soon award contract for a 1 story, 65 x 140 ft. locker building. Estimated cost $40,000. Lockwood Greene Engrs. Inc., 24 Federal St., Boston, are engineers.

Enameling Plant—St. Thomas Stamping & Enameling Co., Ltd., St. Thomas, Ont., is having plans prepared for additions and alterations to enameling plant, including three new enameling kilns. Estimated cost $100,000. J. T. Findlay, 430 Talbot St., St. Thomas, is architect.

Clay Products Plant—Pacific Clay Products Inc., Chamber of Commerce Bldg., Los Angeles, Calif., plans additions to clay products plant at Los Nictos. Estimated cost $250,000.

Foundry—Patterson Foundry & Machine Co., East Liverpool, O., plans the construction of a factory including electric furnace and electric annealing ovens on East End St. Estimated cost $50,000. Private plans.

Drug and Perfume Factory—Connecticut Drug & Perfume Co., 108 State St., New Haven, Conn., is having plans prepared for a 5 story factory on Orange Ave., West Haven. Estimated cost to exceed $40,000. J. Weinstein, Metropolitan Bldg., New Haven, is architect.

Fertilizer Plant—Pacific Bone, Coal & Fertilizer Co., Financial Center Bldg., San Francisco, Calif., awarded contract for a 2 and 5 story plant at South San Francisco, to Barrett & Hilp, 918 Harrison St., San Francisco. $125,000.

Fertilizer Plant—Pacific Guano and Fertilizer Co., Honolulu, Hawaii, is having plans prepared for the construction of a 1 story fertilizer plant at Mahului, Mauri, Hawaii. Estimated cost $75,000. C. W. Dickey, Honolulu, is architect.

Compressor Building and Switch House—Boston Consolidated Gas Co., 250 Stuart St., Boston, Mass., awarded contract for a compressor building and switch house on Cambridge St., Allston, to Somers & Drisco, Park Sq. Bldg., Boston.

Coke and Gas Plant Addition — Consumers Power Co., Jackson, Mich., awarded contract for addition to Becker oven by-product coke and gas plant, including the installation of eleven producer gas heated Becker ovens, 35,000 ton annual coal capacity and daily gas output of 1,200,000 cu.ft. to Koppers Construction Co., Koppers Bldg., Pittsburgh, Pa.

Cyanide Mining Mill—Dome Mines Ltd., South Porcupine, Ont., will soon receive bids for a cyanide mining mill to replace fire loss. $500,000. Private plans.

Cyanide Mill—Porcupine United Gold Mines Inc., Simmons, Canada, plans the construction of a cyanide mill. Estimated cost $250,000. W. C. Owen Co., Guardian Bldg., Cleveland, O., is architect.

Glassware Factory—Macalaster-Bicknell Co., 28 Wendell St., Cambridge, Mass., taking bids for a 1 story, 55 x 100 ft. factory at Moore and Washington Sts. Estimated cost $40,000. Private plans.

Glass Plant Addition—Pittsburgh Plate Glass Co., Grant Bldg., Pittsburgh, Pa., awarded contract for foundation for a 325 x 50 x 100 ft. addition to glass plant at Crystal City, Mo. Estimated cost $1,000,000. H. S. Heichert, c/o owner, is engineer. Also plans 1 story, 162 x 350 ft. warehouse and office at 12th St. and Burlington Ave., Kansas City, Mo. W. Bovard, 907 Ovar-Leslie Bldg., Kansas City, is architect.

Chemistry Building — Virginia Polytechnic Institute, J. A. Burrus, Pres., Richmond, Va., plans additional buildings including chemistry building. Total estimated cost $500,000.

Laboratory — Consolidated Film Industries, Inc., Lemoine Ave., Fort Lee, N. J., awarded contract or a 1 story, 95 x 225 ft. laboratory to A. Cristini & Bros., 5649 Blvd., North Bergen. Estimated cost $120,000.

Laboratory — J. Dixon Crucible Co., Monmouth St., Jersey City, N. J., awarded contract for a 4 story, 50 x 100 ft. addition to laboratory at 344 Monmouth St. to W. Robertson & Son, 15 Exchange Pl., Jersey City. Estimated cost $100,000.

Laboratory (Chemical) — University of Virginia, E. A. Alderman, Pres., Charlottesville, Va., plans to expend $1,000,000 for improvements including chemical laboratory annex, etc.

Plant—Philadelphia Quartz Co. of California, 6th and Grayson Sts., Berkeley, Calif., plans the construction of a plant at South Gate. Estimated cost $500,000.

Plant and Crusher House — International Nickel Co. of Canada, Copper Cliff, Ont., awarded contract or a plant and crusher house to Fraser Brace Ltd., Coppercliff. Estimated cost $125,000.

Nitrogen Oxygen Plant — General Electric Co., M. Trane, Const. Supt., Pittsfield, Mass., will build a 1 story, 60 x 120 ft. nitrogen oxygen plant on East St. Estimated cost $30,000. Private plans. Work will be done by owners forces.

Paint Factory—C. E. Wunder, 1520 Locust St., Philadelphia, Pa., Archt., will receive bids until May 15 for a 2 story, 63 x 105 ft. paint factory at Kingston and Richmond Sts., for Gilbert Spruance Co., Richmond and Tioga Sts., Philadelphia.

Paint and Varnish Factory—Paragon Paint & Varnish Co., 47 10th St., Long Island City, N. Y., plans the construction of a 100 x 100 ft. factory. Estimated cost $75,000. L. A. Abramson, 46 West 46th St., New York, N. Y., is architect.

Varnish Factory—Boston Varnish Co., Boston and Second Sts., Everett, Mass., awarded contract for additions and alterations to varnish factory to Bond Bros., 70 Ferry St., Everett. Estimated cost $140,000 to $160,000.

Paper Mill — International Paper & Power Co., 80 Broad St., Boston, Mass., will build a kraft paper mill at Panama City, Fla.; initial capacity 200 ton daily including two paper machines, each 236 in. in width. Provision is being made so that the capacity of the mill can be increased from 200 to 400 tons daily. Estimated cost $2,000,000. Work will be done by day labor and separate contracts. Power required by the mill will be supplied from its own power plant which will be equipped with boilers and will have an electrical installation of a 13,400 hp.

Paper Plant—Sidney Roofing & Paper Co., Victoria, B. C., is having plans prepared for a plant for the manufacture of insulating board from waste material from cedar shingle mills. Estimated cost $200,000.

Paper Plant—H. F. Watson Paper Co., G. Coney, 143 East 16th St., Erie, Pa., subsidiary of The Rubberite Co., 95 Madison Ave., New York, N. Y., plans the construction of a paper factory at Holland St. between 16th St. and New York Central tracks. Estimated cost $200,000. Architect not selected. Maturity in Spring 1931.

Wall Paper Plant—Robert Gair Co., 420 Lexington Ave., New York, N. Y., will receive bids about Aug. 1 (extended date), for the construction of a 3 story warehouse, etc., in connection with plant at Piermont. Estimated cost $250,000 to $500,000. W. Higginson, 101 Park Ave., New York, is architect.

Chinaware Plant — Corns China Co., Wellsville, O., acquired 32,000 acres of land below McAllen, Tex., which has large deposits of kaolin, a clay used largely in the manufacture of pottery and chinaware; plans a plant for the manufacture of bathtubs, kitchen sinks, etc. Estimated cost $350,000.

Pottery Plant—Hall China Co., East Liverpool, O., awarded contract for the construction of a 1 story, 250 x 680 ft. factory, including two tunnel kilns, etc., for the manufacture of tea pots and other pottery products at Harvey Ave. and Elizabeth St. to Minton-Scobell Co., 679 Arcade, Cleveland. Estimated cost $150,000.

Pottery Plant—D. E. McNicol Pottery Co., East Liverpool, O., awarded contract for a 1 story addition to pottery plant including two new tunnel kilns, warehouse, etc. at Clarksburg, W. Va. to Harrop Ceramic Service Co., Columbus, O. Estimated cost $350,000.

Rayon Plant — Christian, Schwarzenberg & Geade Co., Union Bldg., Cleveland, O., archts., will soon award contract for unit of rayon plant at Covington, Va., for Industrial Rayon Corp., West 98th St. and Walford Ave., Cleveland, subsidiary of Industrial Rayon Corp. of Virginia. Est. cost $1,000,000.

Gasoline Plant — Phillips Petroleum Co., Bartlesville, Okla., is having plans prepared for a second casinghead gasoline plant at Oklahoma City. Estimated cost $100,000. A. H. Riney is engineer.

Gasoline Refinery Units — Atlantic Refining Co., 291 Broadway, New York, N. Y., awarded contract for the construction of four De Florez units to produce 4,000 bbls. of anti-knock gasoline per day from residual oils at Point Breeze refinery, Philadelphia, Pa. to M. K. Kellogg Co., 225 Broadway, New York, N. Y. Estimated cost $2,000,000.

Refinery (Oil) — Compana Espanola de Petroleos, Madrid, Spain, awarded contract for supplying material, erecting and putting in operation a 5,000 bbl. gasoline, kersene and fuel oil refinery at Santa Cruz de Penerisse, Canary Islands, to Bethlehem Steel Co., 25 Broadway, New York, N. Y.

Laboratory—J. Stokes Rubber Co., John St., P. O. Gunkel, Mgr., Welland, Ont., (manufacturers of rubber products) awarded contract for a 50 x 60 ft. laboratory and 40 x 60 ft. machine shop to Gardner Construction Co., 22 Cross St., Welland. Interested in prices complete equipment.

Rubber Factory — Ohio Rubber Co., Willoughby, O., is having plans prepared for a 3 story rubber factory. Estimated cost $400,000. Private plans.

Silk and Rayon Novelty Plant — Warlick Mfg. Co., Newton, N. C., reported, plans an 82 x 100 ft. addition to silk and rayon novelty plant.

Starch Factory Addition — Union Starch & Refining Co., W. G. Irwin, Pres., Columbus, O., awarded contract for a 3 story, 62 x 129 ft. addition to factory at 19th St., Granite City, Ill. to S. M. Wilson, 2025 State St., Granite City. Estimated cost $100,000.

Tile Plant—Albree Marble & Tile Co. Inc 9 Ashland St., Dorchester, Mass., is having sketches made for a 1 story, 100 x 100 ft. plant. Estimated cost $50,000. W. P. Hatch, 60 State St., Boston, is architect.

Tile Plant—Floor & Wall Tile Co., Independence, Kan., c/o C. Friederidosen, San Antonio, Tex., plans the construction of a majolica tile factory including kilns, etc. at San Antonio, Tex. Estimated cost $125,000. Majolica is a clay product of opaque glazing.

Tile Plant — Technical Porcelain Co., 240 Kains Ave., Albany, Calif., plans the construction of a tile plant on Kearney St., El Cerrito. Estimated cost including equipment $40,000.

Welding Plant—Helwig Welding Co., 1374 Springfield Ave., Irvington, N. J., awarded contract for a 1 story, 50 x 110 ft. welding plant at 42-44 Cordied St. to F. D. Trainer & Son Inc., 12 Smith St., Irvington. Estimated cost $40,000.

Zinc Smelter Plant — St. Joseph Lead Co., 250 Park Ave., New York, N. Y., awarded contract for the construction of a zinc smelter plant near Monaca, Pa. for production of both zinc metal and zinc oxide using new electric-thermic process of treating the ore to United Engineers & Constructors Inc., 112 North Broad St., Philadelphia. Estimated cost $3,000,000.

INDUSTRIAL NOTES

HOOKER ELECTROCHEMICAL COMPANY has removed its New York office to 60 East 42d Street.

NATIONAL FILTER CLOTH & WEAVING COMPANY has moved its sales office to 420 Lexington Avenue, New York.

TERRY STEAM TURBINE COMPANY, Hartford, Conn., has appointed T. G. Hart general sales manager at the home office.

RESEARCH CORPORATION has moved its main office to 405 Lexington Avenue, New York, N. Y.

MINERALS SEPARATION NORTH AMERICAN CORPORATION now has its New York offices located at 11 Broadway.

GENERAL REFRACTORIES COMPANY has appointed Harry N. Crowder, Jr., as representative at Easton, Pa., for the adjacent district.

AMERICAN TRANSFER COMPANY, Newark, N. J., has appointed the Westburg Engineering Company, 53 West Jackson Boulevard, Chicago, and Electric Apparatus Sales Company, 10 High St., Boston, as representatives.

BAILEY METER COMPANY has transferred its Chicago office to 20 North Wacker Drive.

FEDERATED METALS CORPORATION has moved its offices to 295 Madison Avenue, New York.

ALLIS-CHALMERS MANUFACTURING COMPANY has moved its Chicago office to 20 North Wacker Drive.

CHAIN BELT COMPANY, Milwaukee, Wis., has moved its New York office to 405 Lexington Avenue, and has appointed R. B. Everett Company representative at Houston, Texas, and J. G. Adams Manufacturing Company at Indianapolis, Ind.

CONNERSVILLE BLOWER COMPANY, Connersville, Ind., has moved its Chicago office to 20 North Wacker Drive and its New York office to 520 Lexington Avenue.

TURBO-MIXER CORPORATION has moved its office to 250 West 43d St., New York, and is moving in its new production facilities at Hudson, N. Y.

THE TEXAS COMPANY has moved its New York offices to 135 East 42d Street.

HARSHAW CHEMICAL COMPANY OF NEW YORK, INC., has moved its New York offices to 405 Lexington Avenue.

CUTLER-HAMMER, INC., has purchased the assets of the Union Electric Manufacturing Company, also at Milwaukee, Wis., which will be operated as a manufacturing division.

CHICAGO BRIDGE & IRON WORKS has moved its Atlanta office to Rhodes-Haverty Building, with R. M. Campbell in charge.

TENNESSEE PRODUCTS CORPORATION, Nashville, Tenn., has combined its offices and research department at 14 Cummins Station.

CLIMAX MOLYBDENUM COMPANY has moved its New York offices to 295 Madison Avenue.

DOW CHEMICAL COMPANY now has its Eastern office located at 60 East 42d Street, New York.

BROWN INSTRUMENT COMPANY, Philadelphia, has consolidated its Chicago office and Mid-Western factory branch at 155 East Superior Street, Chicago.

STRUTHERS-WELLS COMPANY, Warren, Pa., has moved its Chicago office to 20 North Wacker Drive.

REILLY-WHITEMAN-WALTON COMPANY is the new name of the consolidation of S. F Walton Company and Reilly-Whiteman Company, with manufacturing facilities at Conshohocken, Pa.

J. T. BAKER CHEMICAL COMPANY, Phillipsburg, N. J., has opened an office at 1713 Sansom Street, Philadelphia, Pa.

DRIVER-HARRIS COMPANY, Harrison, N. J., has changed its Chicago office to 1138 West Washington Boulevard.

AMERICAN MANGANESE STEEL COMPANY has appointed A. W. Daniels vice-president in charge of sales.

PENNSYLVANIA PUMP & COMPRESSOR COMPANY, Easton, Pa., has appointed E. H. Bollenbacher representative at 725 Forsyth Building, Atlanta, Ga.

EDWARD VALVE & MANUFACTURING COMPANY has appointed the Taubman Supply Corporation its Oklahoma representative at Tulsa.